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THE REACTION OF THE TISSUES TO RADIUM IN TREATMENT OF CANCER OF THE CERVIX AND THE IMPORTANCE OF LACERATIONS IN PRODUCING CANCER IN THIS LOCATION[1]

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IN THE Woman's Hospital in the State of New York, all ward patients with cancer of the cervix who have been treated with radium are urged to return for inspection once each month for a period of 5 years or longer. In the cervix the reaction to radium treatment is so nearly uniform that we believe we know what the appearance of the cervix will be each month if the case is progressing favorably; and that we can tell when the expected effect of radium has not been reached and a subsequent dose is needed. In order that we might fully appreciate the changes taking place in the cervix after irradiation, the medical artist, Miss Emily Freret, attended the follow-up clinic each week and made a series of sketches in water color. A sketch was made of the cervix before the patient received radium treatment and at each successive visit of the patient to the clinic. In this way it has been possible to show a case of cancer of the cervix in its natural color and the progressive alterations through which carcinoma of the cervix passes after irradiation together with the color changes in the cervix. The visits to the clinic were sufficiently far apart to show definite stages in the progress made by radium treatment. Five stages were noted.

A stage of hyperæmia. One week after the initial dose of radium has been given the tissues of the cervix, including, of course, the carcinoma and the adjacent mucosa of the vagina, are intensely red and hyperæmic. The blood vessels are engorged with blood and it is for this reason that we do not consider that a case should be radiated if an immediate operation is imperative.

A stage of slough. One month after irradiation the cervix usually shows an extensive green slough and a foul discharge from the broken down carcinomatous tissue. We believe that this slough must have entirely separated from the cervix before hysterectomy can be performed without great danger of peritonitis resulting from cutting into this necrotic tissue. We do not mean to imply that every case progresses at exactly the same rate of speed, even when favorable results are obtained. Occasionally patients come to the clinic a month after leaving the hospital and there is no indication clinically of slough or carcinoma, the cervix having healed more rapidly than in the average case, while others may present a slough 2 months after the patient has left the hospital or possibly, though this is rare in favorable cases, a part of the slough may still be present on the following visit.

A stage of healing. Usually the third stage, that of healing, is reached 2 months after

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radiation. The appearance of the cervix is now completely changed as the slough has separated leaving a smooth, clean, dusky red cervix which may be somewhat glazed but has clinically no evidences of carcinoma.

A stage of contraction. The following month should show the fourth stage which is contraction. The development of connective tissue which is excited by irradiation markedly reduces the size of the cervix and also the vault of the vagina. Large carcinomatous growths or even craters are contracted by the irradiation to a normal or smaller than normal sized cervix and the vault is as narrow as that seen in senile vaginitis.

The selective and also destructive action that radium exercises upon cancer cells either destroys outright or stuns some of the cells but the principal inhibiting action of radium on cancer is in the stimulation to growth of new connective tissue. The connective tissue enmeshes the cancer cells, shuts off the blood supply, and starves the cancer by forming a "barrier zone" and thus imprisons its victim for a period that may be long or short. Only time can tell the extent of this period.

The stage of marked contraction. At later visits of the patient to the clinic, the fifth or final stage of marked contraction is evident. The increasing amount of connective tissue squeezes the tissues of the cervix until it is finally so shrunken that we are often asked if the cervix has been amputated. There is now little or no vault to the vagina and the mucous membrane is pale with oniy an occasional blood vessel in sight. It is not until this stage has been reached that we are satisfied with the reaction of the cervix to radium. On the road to this goal we find at times that progress seems to have stopped and a second dose of radium is needed but usually the dose is less than the first and frequently only one or two needles of radium are necessary to check a nodule budding out in the cervix or vaginal vault.

It happens not infrequently when the cervix is small and shrunken and the internal os is tightly closed, that the patient who has been making favorable progress up to this time now appears in the clinic looking pale, perhaps septic, and complains of abdominal pain or uterine cramp that even morphine has not relieved. A dilatation of the cervix, gently performed, is almost always followed by a gush of purulent or bloody fluid from the body of the uterus with immediate relief and improvement in the general health of the patient. This treatment may have to be repeated once or twice especially in young women in the menstruating age.

When inspecting the cervices invaded by carcinoma we have been impressed by the frequency with which lacerations were present in the cervix, and decided to study 300 of our consecutive case histories of cancer of the cervix to determine the incidence of pregnancy in this series of cases. In 288 of the 300 cases, 96 per cent, pregnancy terminating with children or miscarriages had occurred. In only 12 cases, 4 per cent, had no pregnancy occurred. It is not improbable that this last figure (4 per cent) would be even lower if we could retake old histories, for a more careful history taken in 3 recent cases revealed the fact that 2 of the 3 patients classed as nulliparæ had borne children and in the third case a miscarriage had occurred at the second month. In a review of the medical literature, Liepmann reports that cervical carcinoma in nulliparæ was found by Kroemer to occur in only 1.77 per cent of cases, by Koblauch in 4.6 per cent, and by Theilhaber and Edelberger in 2.9 per cent.

It is of interest to note that in a series of 50 cases of squamous cell carcinoma of the cervix collected by Dr. Cullen of Baltimore, 49 of the 50 patients had borne children and at least half of the patients were mothers of 5 or more children. In 288 of the case histories just reviewed in the Woman's Hospital, 115 patients had had 5 or more pregnancies and 35 of the 115 had had 10 to 23 pregnancies. It would seem that repeated traumatization of the cervix by labor or miscarriage might be an important influence in the series of changes terminating in carcinoma.

Dr. Cullen also states that Dr. Howard A. Kelly has seen only 3 nulliparæ who had carcinoma of the cervix and in 1 of these an instrumental dilatation had been previously performed. Dr. Cullen believes that traumatization by instrumental dilatation of the

Fig. 3. Cancer of the cervix 1 month after irradiation. Extensive slough present in the cervix.

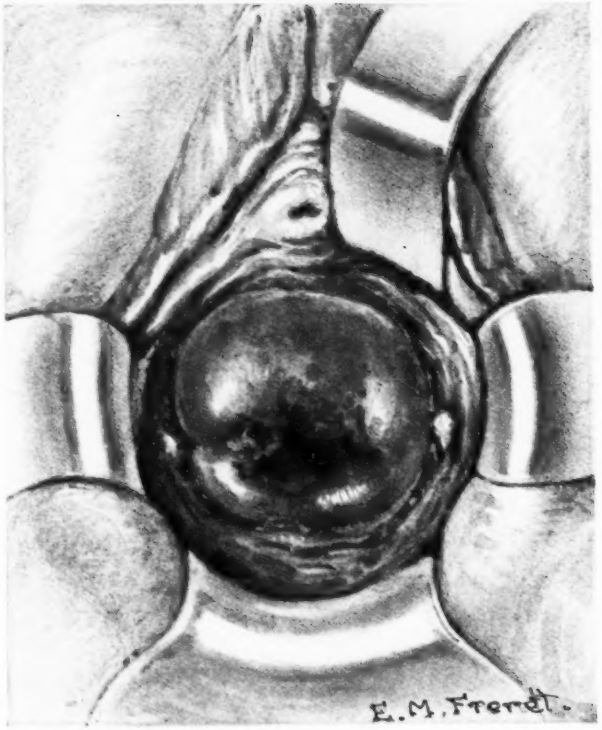

Fig. 4. Cancer of the cervix 2 months after irradiation. Cervix healed.

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cervix is a possible factor in the development of carcinoma of the cervix.

Nearly all of the histories showed hard labors or instrumental deliveries, and frequently the specific statement that the patient had been "badly torn" and "not repaired." In only 9 of the 288 cases in which children had been borne was it recorded that "lacerations" were repaired. In 6 cases the repair had been made after the first delivery and no repair was noted as having been made after the birth of the next child. *In no instance was it specifically stated that the "repair" of laceration mentioned meant that the cervix itself was repaired.*

A search was next made to find the period of time elapsing between the last pregnancy and the occurrence of carcinoma in the cervix. In 206 of the histories it was recorded that carcinoma in the crevix occurred after the last pregnancy as follows:

	Total cases	Per cent	Under 5 yrs.	Under 10 yrs.
3 mos.	1	2.4		
5 mos.	2			
9 mos.	1			
11 mos.	1			
12 mos. to 5 yrs.	18	8.7	11.1	20.3
5 yrs. to 10 yrs.	19	9.2		

In more than one-tenth of the series of 300 cases, cancer of the cervix had occurred less than 5 years after the last pregnancy, and in more than one-fifth of the series cancer had occurred less than 10 years after the last pregnancy.

Years	Cases	Per cent
10 to 20	86	41.7
20 to 30	50	24.4
30 to 35	15	7.2
35 to 40	11	5.3
40 to 45	2	.97
		99.87

The result of severe or repeated injuries in the cervical canal may be seen in the erosion or eversion of the lips of the cervix and in the cystic changes which take place in the glands themselves. Similar changes in the tissues elsewhere in the body are looked upon by pathologists as having an important bearing on the development of cancer. Dr. Ewing says that "evidence points to the origin of carcinoma from previously normal adult cells which pass through a series of changes induced by chronic irritation and terminating in carcinoma." Should we not expect to find cancer developing in the cervix when similar conditions are present there or produce cancer in other locations?

In a recent article by Dr. William J. Mayo entitled "The Influence of Ignorance and Neglect on the Incidence and Mortality of Cancer," Dr. Mayo says: "I have never observed a case of cancer in which there had not been some pre-existing instability of the tissues and a long continued irritation. It would seem as if the long suffering tissues respond to the chronic insult of the injury by supplying for repair, cells less and less mature until finally through sheer inability to supply sound cells to heal the lesion the tissues reach a stage in which there is an uncontrolled production of unsound cells too immature to heal the breach of continuity or furnish surface protection to normally protected tissues."

In the recent meeting of the American Medical Association at Dallas, Texas, a symposium was given in the Section of Obstetrics and Gynecology on "Diseases of the Cervix" and emphasis laid on the importance of healing erosions of the cervix; and the employment of treatment by cautery operation, and various other methods. For the erosions produced by lacerations of childbirth it seems only logical to ask why not repair the lacerations and in view of the changes produced in the cervix after injury that necessitate treatment by cautery which must destroy a portion at least of the cervical tissue, or by amputation which in itself is a serious operation for a woman who hopes to have more children, why not repair the lacerations early? Much has been done and is being done medically in prenatal work to put the expectant mother in the best possible condition and so safeguard her for the labor, but are we giving sufficient attention surgically to the post-natal conditions and especially to the injuries present in the birth canal after the delivery? The teachings of Holmes and of Semmelweiss revolutionized the practice of midwifery and accomplished for the world such economic progress that there is no work comparable to it except perhaps that of

Gorgas; but their work ended with the birth of the child. There seems to be a pause between the termination of the duties of the obstetrician and the beginning of the responsibility of the gynecologist. To whom belongs the patient at this stage?

The practice of obstetrics is a surgical specialty and the obstetrician is or should be a skillful operator. The European *Frauen-Klinik* combines two specialties as one, and in no other way can the patient be adequately cared for than by an obstetrician who is also a gynecologist. Is it good surgical judgment then to leave unrepaired injuries in the cervix that may be a source of morbidity to the patient, an economic loss to society of no little importance if the injury means not only failure to conceive or carry to term future children but if such injury has any influence on the development of malignancy at some later period? Post-natal care of a patient should include repair of injuries to the cervix either by immediate, intermediate or secondary operation depending upon the extent of the injury, the condition of the patient, and whether the operation can be conducted with adequate assistance and aseptic technique. For the primipara delivered in a hospital where all the assistance desired may be obtained, the repair of the lacerations made with the same aseptic precautions as the delivery and with surgical skill and judgment, the result should be satisfactory. Because the operation needed is one of suturing only and the repair is done as a part of the delivery. If the surroundings are not favorable for this work an intermediate operation, so long advocated by Dr. Barton Cooke Hirst, may be preferable. For multiparæ who have old scars in the cervix the injuries may better be repaired at a secondary operation. This to the patient means unfortunately another operation with additional expense and time in the hospital.

A recent survey of the advance of cancer in certain states where most careful registration has been conducted shows a progressive increase in the cancer death rate. The importance of healing infected or eroded cervices is being impressed upon patients, but why not teach them the far more important need of repairing the cause of the lesion—the lacerations which occurred at childbirth and which lead inevitably to these conditions? A secondary operation performed before damage has been done to the cervical tissues need be only a simple trachelorrhaphy necessitating but a few days in the hospital.

In the historic paper of Dr. Thomas Addis Emmet, "Lacerations of the Cervix Uteri as a Frequent and Unrecognized Cause of Disease," first reported before the County Medical Society of New York nearly 52 years ago, Dr. Emmet emphasized the need of early repair of the cervix and in the discussion of this paper Dr. J. Marion Sims said, "I now only wonder that this operation has not been worked out sooner. When the perineum is lacerated the necessity for its reconstruction is self-evident and it is singular that the necessity for reconstructing the integrity of a lacerated cervix did not sooner force itself upon the surgeon. The discussion of the subject must of necessity be one-sided. There can be no objection, no opposition to the operation. We must accept it as Dr. Emmet has given it to us. We can't modify the operation; we can't change it: we can't improve it—for it is perfect—perfect in the method and perfect in its results. We owe to Dr. Emmet a debt of gratitude for this valuable contribution to uterine surgery. Like all new operations it is likely to be abused, but the time will soon arrive when it will assume its place in the foremost rank of useful improvements."

The Emmet trachelorrhaphy seems in the light of newer methods of treatment and technique not to be abused as Dr. Sims prophesied but to be forgotten. With the increasing percentage of cancer of the cervix is it not possible to lessen the menace of this terrible disease by turning back to the teachings of 50 years ago? Inspect the cervix of the recent mother and then employ a technique so simple that when it is performed soon after the injury has occurred it will restore the tissues to normal.

CONCLUSIONS

1. Cancer of the cervix when treated by radium shows a progressive course toward contraction of the cervix and inhibition of the cancer cells in well defined stages of (1)

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Fig. 5. Cancer of the cervix 3 months after irradiation. Cervix pale, beginning to show contraction.

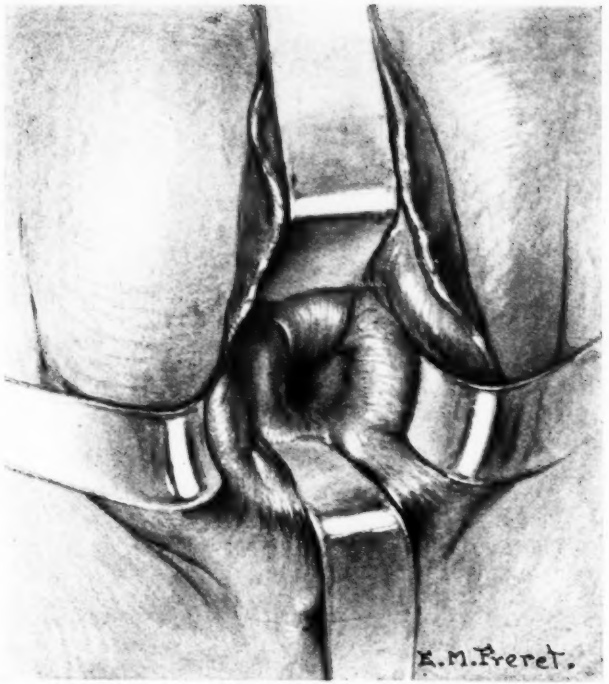

Fig. 6. Cancer of cervix 6 months after irradiation. The lips of cervix have entirely disappeared, vault of vagina and vaginal canal narrowed.

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hyperæmia, (2) slough, (3) healing, (4) contraction.

2. When the cervix is markedly contracted and the internal os closed, pyometra or hæmatometra is not infrequent and is easily treated by dilatation of the internal os and irrigation of the uterine cavity.

3. In 300 consecutive case histories of cancer of the cervix at the Woman's Hospital, it was found that pregnancy (children or miscarriages) had occurred in 96 per cent of the cases. In the 288 cases in which children had been borne, 115 of the patients had had 5 or more than 5 pregnancies and 35 of these had had from 10 to 23 pregnancies. In 288 cases of cancer of the cervix, *11.1 per cent of the patients had had the last pregnancy less than 5 years before entering the hospital for cancer of the cervix*, and 20.3 per cent had had the last pregnancy less than 10 years before entering the hospital for the treatment of cancer of the cervix.

4. A careful palpation and *visual* inspection of every cervix immediately after the confinement and an Emmet trachelorrhaphy performed for lacerations in the cervix would, we believe, lessen the danger of cancer development in the cervix later. Intermediate or secondary repair of the lacerations should be made when conditions do not warrant an immediate repair.

BIBLIOGRAPHY

1. Baumm, H. Die Behandlung frischer Zervixrisse. Muenchen. med. Wchnschr., 1925, lxxii, 1975.
2. Bubis, J. L. The immediate repair of the cervix after childbirth. Cleveland M. J., 1918, xvii, 149.
3. Coffey, Titian. Cervical repair following confinement. Am. J. Obst., 1917, lxxvi, No. 2.
4. Idem. Intermediate cervical repair following confinement. California State J. M., 1923, April.
5. Cullen, T. S. Cancer of the Uterus. 1909, p. 651 and 174.
6. Davis, E. P. The immediate repair of the cervix. Operative Obstetrics. 1912, p. 402.
7. Emge, Ludwig A. The repair of birth lacerations of the cervix uteri; immediate trachelorrhaphy. Am. J. Obst. & Gynec., 1924, vii, No. 1.
8. Emmet, T. A. Lacerations of the cervix uteri. Am. J. Obst., 1874, vii.
9. Ewing, James. Neoplastic Disease. 1919, p. 458.
10. Hirst, B. C. Fifteen years' experience with the intermediate repair of the injuries of childbirth. Am. J. Obst., 1917, lxxv, 752.
11. Hoffman, F. L. Discussion. J. Am. M. Ass., 1925, lxxxv, 1175.
12. Johannsen, Th. Behandlung blutender cervixrisse nach Spontangeburt. Zentralbl. f. Gynaek., 1925, xlix, 1185.
13. Liepmann. Handbuch der Frauen Heilkunde. vol. ii, p. 79.
14. Mayo, W. J. The influence of ignorance and neglect on the incidence and mortality of cancer. J. Indiana M. Ass., 1924, xvii, 331.
15. Polak, J. O. The defects in our obstetric teaching. J. Am. M. Ass., 1921, lxxvi, 1809.
16. Reder, F. Cervical lacerations, their significance for the patient. Am. J. Obst., 1917, lxxvi, No. 5.
17. Reel, P. J. The danger of cervical erosion. Am. J. Obst. & Gynec., 1925, x, 94.
18. Shereschewsky, J. W. Cancer mortality. J. Am. M. Ass., 1925, lxxxv, 1175.
19. Skeel, A. J. Immediate repair of the cervix in childbirth. Cleveland M. J., 1918, xvii, 86.
20. Idem. Tr. Am. Ass. Obst. & Gynec., 1918, xxx, 196.

ANEURISM OF THE RENAL ARTERY

By WILLIAM P. CALLAHAN, M.D., and FRANCES H. SCHILTZ, B.A., M.D., Wichita, Kansas

A CAREFUL search of the literature reveals only 39 cases of aneurism of the renal artery. In 1923 Conroy (2) was able to assemble 31 cases from the literature and to add 1 of his own observation. This number did not include 3 cases published by Newman (4) in 1915. Since 1923 Rowlands (7) has reported 1, Söderlund (9) 1, and Schramm (8) 2 new cases.

On the basis of Conroy's publication and the 7 additional cases we have assembled, we will review a few important facts regarding this condition. Approximately only 1 per cent of all aneurisms affect the renal artery, one-third occurring in the main artery and two-thirds in its branches. The average age is 46 years. Of the 40 cases of aneurism recorded, including the authors', 18 are traumatic, 21 are spontaneous, and 1 is unclassified. Thus 54 per cent are of spontaneous origin. Arteriosclerosis, syphilis, embolism, or some antecedent infection is most commonly the cause of the spontaneous type. Traumatic aneurisms are nearly always false, although 3 were reported with no history of trauma. On the other hand, spontaneous aneurisms are usually true, but here again 2 cases followed trauma. Nineteen of the above cases are false, 19 are true, and 2 are unclassified.

The most important sequelæ are (1) rupture into the pelvis, producing hæmaturia; (2) rupture into the peritoneal cavity with no consequent hæmaturia; and (3) destruction of the kidney. In 18 cases, the aneurism ruptured into the pelvis, 12 being false and 6 true. In only 2 was the rupture into the peritoneal cavity, both being false. Destruction of the kidney is quite characteristic of the false type; true aneurisms cause very little destruction of the renal substance in comparison. Key and Akerlund mentioned "small round celled infiltrations," and Söderlund "infarct formation" as secondary consequences.

According to Conroy the syndrome of aneurism of the renal artery is abdominal pain closely followed by hæmaturia. In his collection, hæmaturia occurred in 15 of 28 cases with reliable histories; in the 7 cases we have assembled and our own it was present 6 times, absent once, and history was insufficient in 1. In the 35 cases with histories, hæmaturia was present in 60 per cent. The tendency of the hæmorrhage to cease and to recur at intervals of a few days to 1½ years is quite characteristic. Three cases were reported in which death occurred within 2 weeks, due to exsanguination. Pain is not a very reliable symptom, as it is so often associated with trauma when organs other than the kidney may have been injured. In 2 of Newman's cases, pain was associated with micturition and was probably due to blood clots in the ureter. Söderlund attributed the attacks of "cutting pain" in his case to a renal infarct. In our case the type of pain suggested pressure on the renal plexus.

The most valuable sign is a palpable tumor in the kidney region. This was present clinically in 16 of Conroy's 28 cases with reliable histories; Schramm reported one with tumor which also had pulsation and a bruit. In 17 out of 36 cases, 47 per cent, tumors were present clinically. Conroy reported pulsation in 2 and a bruit in 1 case.

Although no absolute division of the types can be made clinically, yet it will be simpler to consider them in groups. The false aneurisms which are usually of traumatic origin are more often associated with pain, hæmaturia, and a tumor than are the true aneurisms. According to Conroy these may be mistaken for (1) hydronephrosis, (2) renal neoplasm, and (3) ruptured kidney. In hydronephrosis there is usually no history of antecedent trauma, hæmaturia is generally absent, and the size of the tumor varies. In aneurism the pain is intermittent, the onset of weakness and anæmia is sudden, and cachexia is absent as contrasted with a renal neoplasm. Nothing short of an exploratory operation will make it possible to differentiate between aneurism and

Fig. 1. Roentgenogram of left kidney showing the shadow of the aneurism.

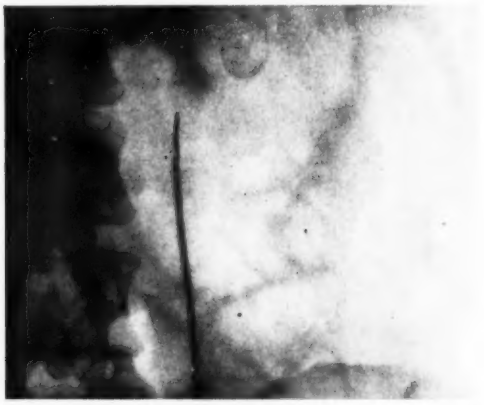

Fig. 2. Roentgenogram of left renal region showing shadow and catheter *in situ*.

ruptured kidney. Newman observed during cystoscopic examination in 2 cases, that "when pressure was made with the kidney between the hands, one behind and the other in front, blood was seen to flow from the ureter, and when the pressure was withdrawn the flow ceased."

The true aneurisms may persist over long periods of time without causing symptoms, although hæmaturia, pain, and tumor may occur. In 5 cases, Barnard's, Conroy's, Key and Akerlund's, Söderlund's and our own, the aneurism was calcareous. The roentgenogram showed positive findings in the last three named. The conditions most likely to be confused with these calcareous aneurisms are (1) retroperitoneal glands, (2) renal calculus, and (3) cholelithiasis. Newman writes: "symptomless hæmaturia in renal tuberculosis is a more common occurrence than is generally suspected." In all cases of symptomless hæmaturia a cystoscopic, a roentgenological, and a bacteriological examination should be made, as well as the chemical and physical examination of the urine.

The shadows obtained by roentgenological examination of our patient were unique and very similar to those obtained by Key and Akerlund, and Söderlund. The former described "a round shadow of a calculus, the size of a pea, with shell-shaped deposit on surface, calculus of urates with shell of carbonated phosphates." Söderlund recognized the similarity between the shadow obtained in his case and the one just described. His preoperative diagnosis of aneurism of the renal artery was correct.

Conroy states that all cases which give rise to symptoms have a 100 per cent mortality unless an operation is performed. Without operation, death may occur from 2 days to 5 years after onset. In the small true aneurisms the prognosis is much less serious, and in those which have become calcified, rupture is

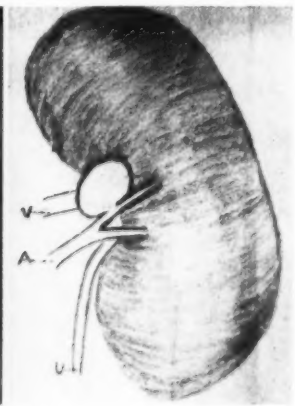

Fig. 3 (left). Photograph of aneurismal sac.
Fig. 4. Schematic diagram showing site of the aneurism. *v*, Vein; *a*, artery; *u*, ureter.

Figs. 5 and 6. Photomicrographs showing section through aneurismal sac and artery wall. Note abrupt cessation of elastic layer. Low and high power.

improbable. Söderlund questions the advisability of removing calcareous aneurisms, especially if a nephrectomy must be resorted to, unless the pain is severe.

In the 12 operations performed up to the present, 10 were cured and 2 died. Nephrectomies were done in 10 cases. In Orth's case, he was able to turn out the clots and successfully suture the tear, and in the authors' case it was also possible to excise the sac and preserve the artery. Orth reported good function 1 year later, and in our case the function is good up to the present, 6 months following operation.

In spite of the convincing clinical picture presented by Richardson in a case recently published by him, this is not included in the tabulation (Table I).

Our own observation was as follows:

Mrs. T., aged 44, presented herself complaining of abdominal pain and backache, chiefly on the left. This trouble began about 6 years ago, but became progressively worse the last 2 years. Eighteen months ago the patient had an attack of sharp, intermittent pain lasting 2 days, so severe she could not sleep, relieved only after a hypodermic had been given. This sharp lancinating pain started in the epigastrium and then radiated to the hypogastrium. During this attack she remained in bed about a day. Her menses commenced the same day, and as soon as the flow was well established, the severe pain ceased, only a sense of soreness remaining. During the past year, there has been some postural relief when she leaned to the left. The patient has not been able to perform her household duties for the last 3 months but had no further acute attacks until 4 days ago, again simultaneous with her menstrual period. This attack was similar to the first, but more severe, four hypodermics being given by her local doctor before relief was obtained. After admission to the hospital, there was no more acute pain, but some abdominal soreness and the lumbar ache persisted. There was some nausea but no vomiting. There was no history of trauma. Nocturia was present once or twice each night, but there was no day frequency. The patient gained in weight and her appetite was excellent.

The physical examination was of a well developed and nourished individual. There was some arteriosclerosis of the periperal vessels. The systolic blood pressure was 142, the diastolic 80. The heart was slightly enlarged to the left but was otherwise normal. The abdomen was full and rounded but not distended; there was no rigidity, but some tenderness in the left lumbar region. The kidneys were not palpable but tenderness was elicited over the left. A pelvic examination revealed no abnormalities. The leucocyte count varied from 11,100 to 15,750. The urinalysis, which was done repeatedly, showed

TABLE I.—CASES REVIEWED AND REPORTED SINCE 1915.

Reported by	Date reported	Traumatic	Spontaneous	Unclassified	False	True	Unclassified	Hæmaturia	Pain	Tumor	Operation	Prognosis: With Operation	Prognosis: Without Operation	Remarks
1–32 Conroy	1923	17	15		18 (15 traumatic; 3 no trauma)	13 (11 spontaneous; 2 traumatic)	1	+ in 15 of the 28 cases	In 14 of 19 cases it occurred associated with trauma. Unreliable symptom	+ in 16 of the 28 cases	5 nephrectomies 1 excision of aneurism; kidney preserved	3 cured 2 died 1 cured	100% mortality in cases which gave rise to symptoms Good in cases which do not give rise to symptoms	28 cases with reliable histories
33 Newman	1915		1			1		+	+ during micturition because of clots	—	Nephrectomy	Cured		
34 Newman	1915		1			1		+	+ during micturition because of clots	—	Nephrectomy	Cured		
35 Newman	1915			1			1	+	—	—			Autopsy	Insufficient history
36 Rowlands	1924		1			1		+	—	—	Nephrectomy	Cured		
37 Söderlund	1925		1			1		Very slight	+	—	Nephrectomy	Cured		
38 Schramm	1925	1			1			+	+	+ also pulsation and bruit	Nephrectomy	Cured		
39 Schramm	1925		1			1		?	?	—.			Autopsy	Insufficient history

no blood cells or albumin, chlorides were 0.18 per cent, and urea was 1.84 per cent. A cystoscopic examination showed a mild trigonitis, due to a moderate degree of cystocele; the ureters were patent throughout, and there was a free flow from each kidney, though more abundant from the right side. A phenolsulphonephthalein test gave a total of 77 per cent. The blood urea was 46.9 milligrams per 100 cubic centimeters.

A roentgenogram showed a shadow approximately the size of a hazel nut in the upper region of the left kidney; the periphery was very dense, while the interior was quite diffuse; the right kidney appeared normal. A pyelogram showed the pelves to be of normal position, size, and shape. The oblong blunt shadow on the left lay anterior to the plane of pelvic projection and encroached upon it. Although the shadow was not typical of stone, yet it was suggestive, and a tentative diagnosis of renal calculus was made.

Operation. An oblique lumbar incision was made and the kidney exposed by an extraperitoneal approach. A hard, round mass, the size of a walnut, was found intimately associated with the renal pelvis and loosely connected with the renal artery just distal to its bifurcation. There was no pulsation and even at this time it was not possible to rule out calculus. In an effort to dissect the mass, a small incision was made and immediately a blood spurt from the sac revealed its true nature. Fortunately, the aneurism was of the sacculated variety and hæmorrhage was controlled by clamping the sac at its communication with the artery. It was also ligated at this point and the sac excised. The perforation in the artery was closed without sacrificing the artery or any part of the kidney. The renal arteries were arteriosclerotic. (Figs. 3 and 4.)

Pathological report. Specimen consists of a cystic tumor, with hard calcareous wall. It is almost spherical, its diameters being 2.6 and 2.3 centimeters. On one pole there is a small opening 2 millimeters in diameter, with the impression of a hæmostat, the site of dissection from the artery. The interior is shining, yellowish white and smooth, with the exception of 2 small reddish brown thrombi. The calcification of the wall is due to a calcific lamina of three-eighths millimeter thickness forming a continuous layer in the wall and being interrupted only at the entrance of the artery into the sac. (Figs. 5 and 6.)

Microscopical examination was made by Dr. Hellwig. Section through the entrance of the sac shows part of the wall of the renal artery (upper half of Figs. 5 and 6). The intima is thickened and the media is infiltrated by fat partially replacing the elastic and muscle tissue. In the lower half of the figures, the media is shown interrupted against the newly formed wall of the sac. Here the wall consists mostly of broad hyaline connective tissue. The intima is flattened and the adventitia is incorporated

with the surrounding structures. There is no evidence of syphilitic change.

Pathological diagnosis: arteriosclerotic saccular aneurism of the renal artery.

Twelve days following the operation, the blood urea had come down to 34 milligrams per 100 cubic centimeters as compared with 46.9 milligrams 2 days preceding operation. The patient made an uneventful recovery and was dismissed from the hospital 2 weeks after operation. During the 6 months since her operation there has been no recurrence of the abdominal pain or the lumbar ache.

CONCLUSIONS

1. This case brings the total number of reported cases of aneurism of the renal artery up to 40. It may be classed with the spontaneous and true aneurisms.

2. Abdominal pain was present but hæmaturia was constantly absent. There was no palpable tumor and no pulsation. None of the classical symptoms of aneurism was present.

3. During the acute attacks which the patient had, relief was obtained after the menstrual flow was well established. We could not explain this fact satisfactorily.

4. The roentgenogram provided the principal aid in diagnosis. The shadow was unique. The periphery was dense and outstanding while the center was diffuse. This is the third case of aneurism of the renal artery in which positive roentgenological findings have been noted.

5. In 10 of the 12 operative cases previously reported, nephrectomies were performed. Fortunately, the aneurism was so situated in this case that the kidney could be preserved. This is the second case on record in which the kidney has been preserved.

6. Operative mortality is 17 per cent, while in those cases which give rise to symptoms and are not treated surgically, it is 100 per cent.

BIBLIOGRAPHY

1. Barnard, H. L. Tr. Path. Soc. Lond., 1900–01, lii, 254.
2. Conroy, M. J. Ann. Surg., 1923, lxxviii, 628–640.
3. Key, E., and Akerlund, A. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1917–18, xxv, 551.
4. Newman, D. Brit. J. Surg., 1915, ii, 560.
5. Orth, O. Deutsche Ztschr. f. Chir., 1919, cli, 272.
6. Richardson, G. B. Brit. M. J., 1925, i, 70–71.
7. Rowlands, R. P. Brit. M. J., 1924, ii, 939–940.
8. Schramm, H. Ann. Surg., 1925, lxxxi, 105–107.
9. Söderlund, G. Acta. Chir. Scandinav., 1925, lviii, 649–665.

DILATATION OF THE BILE DUCTS (HYDROHEPATOSIS)[1]

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THE effect of obstructive lesions of the bile ducts on the parenchyma of the liver and the biliary tree has been known for many years. Frerichs, in 1858, made the first comprehensive study of the subject, and his conclusions have in the main been confirmed by subsequent investigators. Wyss and Leyden tied the common bile ducts in cats and dogs, and described the resulting dilatation of the biliary passages with the associated fatty changes in the hepatic cells. Mayer, in 1872, repeated this work and obtained the same results, but also found atrophy of the hepatic cells, together with lymphocytic infiltration of the parenchyma. In the same type of experiment, Legg, in 1873, noted among the earliest clinical phenomena, emaciation and jaundice. Dilatation of the ducts extending to the smallest radicles was seen, together with very marked increase in the connective tissue surrounding them. From the absence of glycogen in the cells he concluded that the glycogenic function of the liver was soon lost. This work was further extended by Harley and Barratt, who ligated the left hepatic bile duct in a series of cats and found that very little gross change occurred in less than 4 months. After 6 months, however, the capsule was wrinkled and the lobules were more prominent on the left than on the right. After 12 months, other changes were plainly visible. Marked atrophy of the left lobe had taken place with considerable superficial scarring. The bile ducts were found dilated throughout their course, tortuous, varicose, and filled with viscid yellowish fluid. Microscopically, atrophy of the hepatic cells had occurred with marked formation of fibrous tissue at the terminal bile ducts and proliferation of the finest branches in this situation. In short, obstructive biliary cirrhosis, as defined by MacCallum, had occurred. More recently, Rous and Larimore have extended these experimental observations (31).

In regard to the liver of man, Ford and Weber were among the earliest to draw attention to the changes occurring in the bile ducts and parenchyma from obstruction due to stones, confirming in general the results obtained by experiments on animals.

In this study we wish to depict the extent of the damage in various types of obstruction by a method which lends itself particularly well to the purpose, namely, the celloidin-injection and corrosion method. It was one much used by the earlier anatomists in the demonstration of normal structures and occasionally for pathological purposes, although not so much as its usefulness warrants. More recently it has been applied to the kidney by Golubew, Brödel, Hinman, Morison, and Brown, to the lungs by Marquis, and to the submaxillary gland by Flint and Marshall (mostly for study of the normal). By this means the specimen is easily studied, and forms a valuable addition to any pathological museum, especially if exhibited along with the gross specimens preserved by the usual methods.

The material was all obtained from unembalmed subjects at necropsy. For comparison, normal livers were first injected and casts made of the normal biliary tree. A selection of cases of various lesions of the biliary tract was then obtained and similar preparations made. We have thus four series of preparations, one showing the normal, and three the effect of various grades of cholecystitis and cholelithiasis, of cholecystectomy, and of benign and malignant stricture.

METHOD

Our method has been that of Hinman, Morison, and Brown with certain important modifications. As soon after death as possible, the liver is dissected from the abdomen complete with the diaphragm, and as much of the superior and inferior venæ cavæ as possible.

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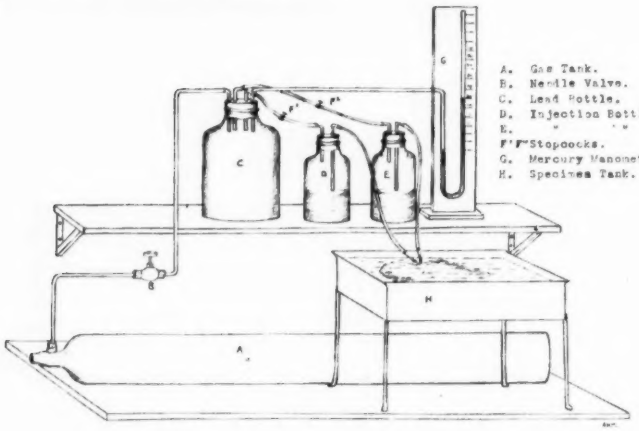

Fig. 1. Injection apparatus.

The gastrohepatic omentum containing the portal vein, hepatic artery, and bile duct is severed close to the duodenum. Great care is taken not to injure the capsule of the liver at any situation, or leakage will occur. Cannulas with as wide a lumen as possible are then placed in the portal vein and common duct, and a stab hole made in the fundus of the gall bladder.

The portal vein is connected by rubber tubing to an ordinary cold water faucet and the liver immersed in a tank of cold water. The tap is gradually turned on until there is a free flow from the hepatic veins and the liver itself is tense almost to the bursting point. We have not found it necessary to use an isotonic solution in washing out before injecting either the bile ducts or blood vessels, ice-cold water being entirely satisfactory. Washing is carried on for varying periods up to 12 hours. The difficulty is to remove the bile from the blindly ending system of ducts, and satisfactory injections can be obtained only when this has been successfully accomplished. The high pressure within the capsule is used first to squeeze out as much bile as possible just as one would squeeze a sponge, and second to cause the water to filter through into the ducts and so wash out the viscid contents. Puncturing the gall bladder prevents overdistention of that organ. When washing is complete the liver is removed and wrapped in towels; weights up to 15 pounds are then laid on it. The towels are repeatedly changed so that in a few hours the accumulated fluid within the organ is removed and it assumes a shrunken appearance and clayey consistency. This method was first advocated by Beale, and with it we have been able to produce much improved specimens.

The cystic duct is next clamped off and the liver connected to the injection apparatus (Fig. 1). This consists of gas cylinder *A*, connected through a needle valve *B* to a lead bottle *C*. To this any number of injection bottles, *D* and *E*, containing injection fluid can be connected, according to the number of vessels to be injected. A manometer *G* records the pressure. The injection fluid consists of a solution of celluloid in acetone prepared according to the method of Hinman, Morison, and Brown. Although we keep the *A* and *B* solutions stocked as recommended by them, we do not use any fixed dilutions for injecting, but vary them according to the vessel to be injected and the type of injection required. Experience will determine the most suitable consistency. For the bile ducts we find that a preliminary injection of such watery consistency that it drips easily from a glass rod, followed by one like thick cream, gives very satisfactory results. We have discarded the dyes commonly used as coloring agents, and have found artists' oil paints,

of any standard quality, superior, particularly in the smaller branches where an opaque bright, permanent color is desirable.

Before the tube from the injection bottle is connected to the cannula, the former is filled with fluid to exclude as much air as possible. All connections are then made tight and the pressure rapidly raised to 360 millimeters of mercury and maintained at that level for 6 hours. At the end of this time the thick solution is substituted for the thin one and injection proceeded with for another period of from 24 to 36 hours at a pressure of 200 millimeters. At the same time a slow stream of cold water is run through the portal vein in order to wash out the accumulated acetone and so facilitate the hardening of the smaller branches. The lengthy injection period serves the purpose of completely filling all the branches, so producing a solid cast, and at the same time preventing the shrinkage which is likely to take place if hardening occurs after the pressure is released. Sections for microscopic examination can be safely taken at any time after the smaller branches are set.

By palpating the common duct, one can judge how the hardening process is progressing; as soon as this is considered to be complete the liver is removed from the tank and immersed in concentrated hydrochloride acid for from 4 to 5 days. The parenchyma is rapidly corroded; any material adhering to the branches of the bile duct is washed away with a fine stream of cold water. A perfect specimen, including the parietal sacculi and vasa aberrantia, should thus be produced. The specimen is best mounted on a sheet of glass perforated with small holes, through which the branches can be secured with fine thread. It is then sealed in jars containing a sprinkling of camphor on the bottom covered by a sheet of wet blotting paper, according to the method of Lundquist. By this means the celloidin is prevented from drying and becoming brittle.

RESULTS

In all, twenty-six livers of the four types previously mentioned were examined by this method, the change in the caliber of the ducts being measured as accurately as possible by fine external calipers and screw gauge. Although shrinkage has been eliminated as much as possible by hardening under long continued pressure, there is no doubt that a certain amount occurred, but it was so slight as to be practically negligible. Since this factor was practically constant throughout, the method and conditions being identical for all cases, the measurements afford a good index of the changes in internal diameter of the biliary passages. In the tables under each type, a brief outline of the clinical history and principal lesions is given, together with the diameter of the common hepatic ducts, right and left hepatic ducts, and branches of the first, second, third, fourth, and fifth orders.

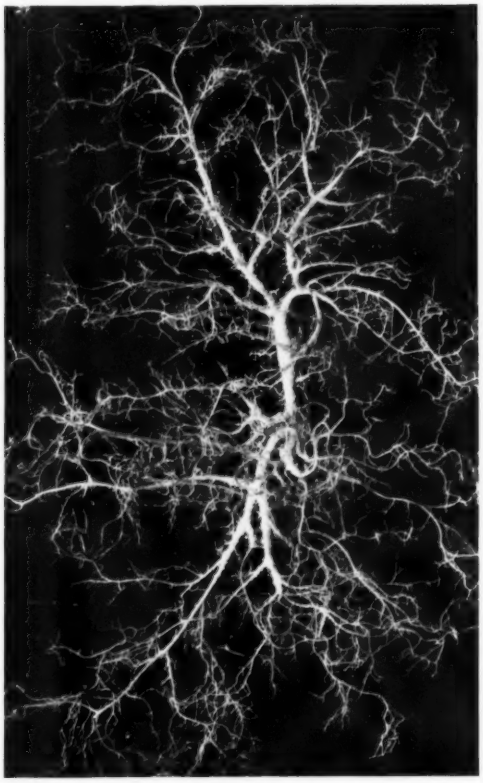

Fig. 2 (Case 2). Normal biliary tree showing slender branches, vasa aberrantia, and parietal sacculi. (Examine with hand lens.)

Fig. 3 (Case 17). Cholelithiasis and functionless gall bladder; generalized mild dilatation of ducts.

A thorough study of ten biliary trees from normal livers was first carried out in order to establish a criterion for the comparison of abnormal types. Figure 2 (Case 2) represents a cast of this description. The common and hepatic ducts form a comparatively slender trunk varying in diameter from 2.1 to 4.8 millimeters. Five millimeters was therefore taken as the greatest normal diameter in this situation. Within the hilus of the liver the common hepatic divides into right and left branches, and these in turn form five or six smaller branches. By a descending order of divisions, diminishing in size but increasing in number, the remainder of the tree is built up until at the fifth order the ducts have become mere filaments. The right hepatic duct varies in size from 1.6 to 3.4 millimeters, the left from 1.4 to 3.6 millimeters. Sometimes the left duct is wider than the right, although the reverse occurs more frequently. In the succeeding branches those of the first order vary from 1.1 to 2.2 millimeters, those of the second from 0.8 to 1.5 millimeters, those of the third from 0.3 to 0.8 millimeters, those of the fourth from 0.1 to 0.3, and those of the fifth from 0.05 to 0.1 millimeters (Table 1).

As far as the ducts themselves were concerned and exclusive of the vasa aberrantia, no anastomosis between the two sides was found as far out as the fifth order of branchings, a condition which we have demonstrated in the portal vein as well. That is to say, outside the canalicular circulation of bile and the capillary and venular circulations of the portal blood there is no gross anastomosis between the right and left branches of bile ducts or portal vein. In the case of the hepatic artery, a slightly more marked arteriolar anastomosis from side to side is usually established (22).

As Mall has shown, the finest bile ducts are given off from the fifth order of branchings onward. In some of our injections as many as six orders could be counted, although many terminated at the fourth division. It can, therefore, be assumed that the injection mass has penetrated to at least within one branch of the hepatic columns or just proximal to those finer ducts which undergo such marked proliferation in cases of obstructive biliary cirrhosis.

Between the right and left hepatic ducts, in the transverse fissure, in the left coronary ligament and in the membranous bridge which unites the spigelian and right lobes behind the inferior vena cava, are a number of anastomosing tubules arising from opposite sides of the ducts, and appearing as tortuous, curled, branching processes ending frequently in cap-like dilatations. To these structures Weber gave the name of vasa aberrantia, considering them to be the remnants of previously functioning ducts. In the transverse fissure they form a slight anastomosis between the right and left hepatic ducts. Besides these structures are the two rows of parietal sacculi (2) or mucous glands (34). In regular fashion they sprout from opposite sides of the lumen, and within the wall form an anastomosing cluster of small vessels dilated at their distal ends, and frequently connected with the vasa aberrantia. It is rather a curious fact that

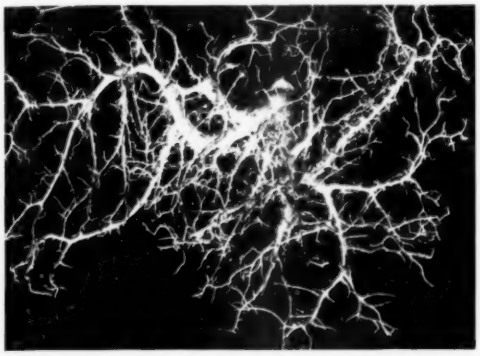

Fig. 4 (Case 21). Cholelithiasis and choledocholithiasis; generalized dilatation.

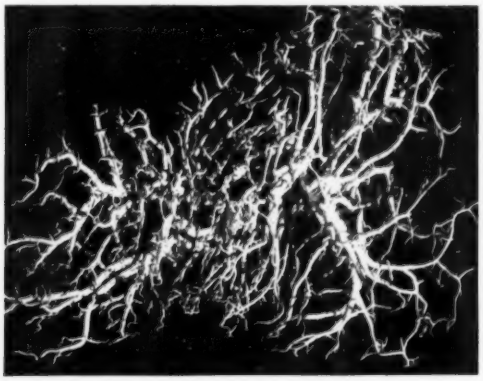

Fig. 5 (Case 22). Incomplete benign stricture; beginning sacculation of ducts with mild clubbing.

practically all the branches of the biliary tree, together with the vasa aberrantia, arise from opposite sides of the duct along the lines of a parietal sacculi. In general, therefore, the duct wall shows two smooth surfaces separated by two rows of afferent ducts. The parietal sacculi can be traced throughout the course of the duct as far out as those measuring 0.1 millimeter in diameter. The effect of pathological processes on these structures will not be considered at this time.

CHOLELITHIASIS

Eight cases were examined in which careful clinical investigation had failed to show any evidence of previous biliary disease, and in which the presence of stones in the gall bladder and their absence in the common duct was revealed only at necropsy. It seemed safe, therefore, to exclude the effect of stones in the common duct in considering changes produced in that situation. In seven cases, evident dilatation of the ducts had taken place, mild in degree but present throughout the whole system. Thus the common hepatic duct varied in diameter from 6.5 to 11.5 millimeters, the right hepatic from 3 to 8 millimeters, the left hepatic from 3.5 to 7 millimeters, the first order from 2.5 to 5 millimeters, the second from 1.7 to 3 millimeters, the third from 0.7 to

TABLE I.—DIMENSIONS OF NORMAL BILIARY TREES

Case	Sex	Age	Diagnosis	History of biliary disease	Condition of gall bladder	Obstruction of common duct	Diameter of ducts—mm.							
							Hepatic			Successive branches in descending order				
							Common	Left	Right	First	Second	Third	Fourth	Fifth
1	F	25	Placenta prævia	None	Normal	None	4.	3.5	3.	2.1	1.5	0.7	0.1	0.05
2	M	47	Tumor of brain	None	Normal	None	3.	2.7	2.2	1.5	0.9	0.4	0.2	0.05
3	M	57	Carcinoma of stomach	None	Normal	None	4.	3.1	4.	2.	1.1	0.8	0.2	0.1
4	M	47	Carcinoma of nose	None	Normal	None	4.1	2.8	3.1	2.2	1.4	0.6	0.3	0.08
5	F	67	Tumor of brain	None	Normal	None	3.8	2.4	2.6	1.2	1.	0.8	0.2	0.1
6	F	21	Dermatomyositis	None	Normal	None	3.9	2.6	2.8	1.4	1.1	0.5	0.3	0.1
7	F	54	Coronary thrombosis	None	Normal	None	3.8	3.	3.1	2.	1.2	0.6	0.2	0.07
8	F	31	Pyelonephritis	None	Normal	None	2.1	1.4	1.6	1.1	0.8	0.3	0.1	0.05
9	M	43	Tumor of cord	None	Normal	None	4.8	3.6	3.2	2	1.	0.5	0.2	0.1
10	M	50	Syphilis of central nervous system	None	Normal	None	4.6	3.	3.4	2.	1.	0.5	0.1	0.05

TABLE II.—DIMENSIONS OF BILIARY TREES IN CASES OF CHOLELITHIASIS AND FOLLOWING CHOLECYSTECTOMY

Case	Sex Age	Diagnosis	History of biliary disease	Condition of gall bladder	Obstruction of common duct	Diameter of Ducts—mm.							
						Hepatic			Successive branches in descending order				
						Common	Left	Right	First	Second	Third	Fourth	Fifth
11	F53	Fibromyoma; hysterectomy	Indigestion 5 years	Three stones; partial function	None	4.	3.	3.5	2.	1.1	0.9	0.5	0.1
12	F51	Myocardial degeneration	None obtained	Multiple stones; functionless (?)	None	6.5	3.5	3.	2.4	2.5	1.	0.4	0.1
13	F69	Cerebral hemorrhage	None obtained	One large stone; partial function (?)	None	6.7	6.	4.9	2.8	1.7	0.7	0.2	0.1
14	F54	Carcinoma of ovaries	None obtained	Multiple stones; functionless	None	7.5	3.8	3.2	2.4	2.7	1.	0.5	0.2
15	M68	Myocardial degeneration	None obtained	Multiple stones; functionless	None	8.	5.1	5.	3.2	2.1	1.	0.4	0.05
16	M54	Abscess of lung	None obtained	Multiple stones; functionless	None	10.	4.	5.	2.5	2.	1.	0.4	0.1
17	M65	Rectal polyposis; peritonitis	None obtained	Multiple stones; functionless	None	10.	7.	8.	5.	3.	1.5	0.5	0.1
18	F56	Hyperthyroidism	None	Multiple stones; functionless	None	11.5	6.	7.	4.	3.	1.5	0.5	0.1
19	M45	Cholecystitis; cholecystectomy	Nausea, vomiting, recurring colic in right upper quadrant 12 years	Gall bladder excised 9 days before; internal fistula; multiple stones	None	5.1	3.8	4.	2.	1.5	0.7	0.2	0.1
20	F40	Cholecystitis; cholecystectomy	Nausea, distress in right upper quadrant 1 year	Gall bladder excised 8 days before; multiple stones	None	7.1	5.3	5.4	3.9	2.1	1.2	0.7	0.1
21	F62	Cholelithiasis; cholecystectomy	Two attacks of jaundice; colic 30 years	Gall bladder excised 10 days before; contracted and fibrous	Stones	9.	8.	7.5	4.8	3.5	1.4	0.2	0.1

1.5 millimeters, the fourth from 0.2 to 0.5 millimeters, and the fifth from 0.05 to 0.2 millimeters (Table II). Comparing these with the figures obtained from the normal specimens, it will be seen that the increase is fairly uniform throughout, although greatest in the extrahepatic ducts. The diminution in size is a gradual and insensible process not confined to any one set of branches. Case 11, in which no dilatation of the ducts occurred, showed an absolutely normal biliary tree. An examination of the gall bladders in this series brings to light some interesting facts. The gall bladder in Case 11 contained three small stones, but to all appearances was normal, showing no inflammatory thickening, adhesions, or dilatation. In other words, the organ must have preserved at least some measure of function. In Cases 12 and 13 the condition was similar, although evidences of chronic cholecystitis were more obvious here. In Cases 14 to 18 the gall bladder was filled with stones and showed extensive thickening and fibrosis of the wall, while in Cases 17 and 18 the gall bladders were reduced to fibrous sacs and were certainly functionless. Case 17 (Fig. 3) is typical of the group. The outstanding point is that the amount of dilatation of the ducts runs parallel and is directly proportional to the amount of pathological change in the gall-bladder wall and to its loss of function. It is of course not to be concluded that such loss of function is the sole factor in producing the dilatation.

CHOLECYSTECTOMY

Cases in which cholecystectomy has been performed are unsatisfactory, and we lay little stress on them from the point of view of the effect of the entire absence of the gall bladder. Death occurred 8, 9, and 10 days following cholecystectomy which was performed because the gall bladder was entirely functionless. In none, therefore, can any change be attributed

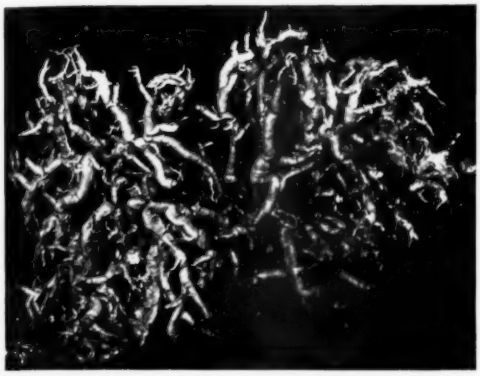

Fig. 6 (Case 23). Complete malignant stricture of 6 weeks' duration; marked sacculation and clubbing of ducts.

to the operative loss of the gall bladder. In all these cases dilatation of the ducts was similar to that observed in the last series, but was most marked in Case 21 (Fig. 4) in which stones were found in the common duct. In Case 19 dilatation was very slight and attained only 5.1 millimeters in the common hepatic duct. This is explained by the fact that at operation an internal fistula was discovered between the gall bladder and the transverse colon which provided for drainage of the biliary system.

STRICTURE

From Table III it will be noted that one stricture was benign and four were malignant, the latter causing far greater dilation than the former. The preponderance of the latter was due to the technical difficulties encountered in introducing a cannula into ducts, frequently a mass of scar tissue at the hilus, or disorganized by operative intervention. In four cases marked chronic cholangeitis had been established, while in one the process was acute, and multiple abscesses had formed.

The variation in diameter in the hepatic ducts lay between 10 and 30 millimeters, the right and left hepatic ducts being from 7.5 to 16 millimeters and from 8 to 20 millimeters respectively. The extent to which the process had been carried was indicated by the dilatation of the succeeding branches; the diameter varied from 4.8 to 13 millimeters for the first

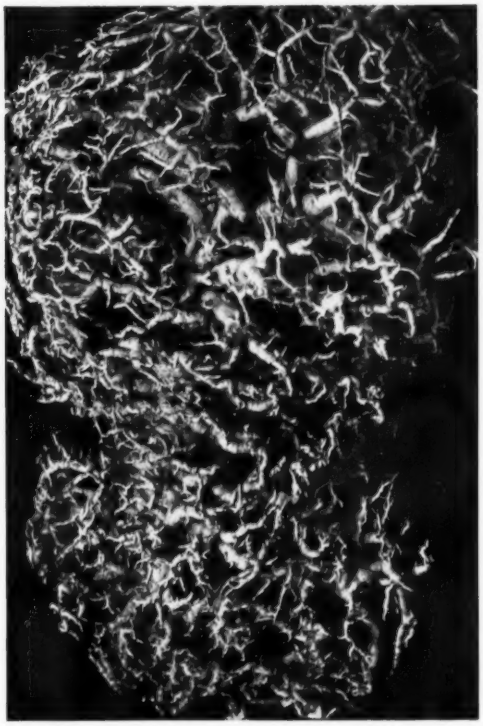

Fig. 7 (Case 24). Complete malignant stricture of 8 weeks' duration; extreme hydrohepatosis.

order, from 3.5 to 8 millimeters for the second, from 1.4 to 6 millimeters for the third, from 0.2 to 1 millimeter for the fourth, and from 0.1 to 0.2 millimeter for the fifth. It will be noted that the longer and more complete the obstruction, the greater the dilatation and the further out it extends. Between the third and fourth branches, however, a rapid transition takes place, so that the fifth branch appears as a terminal filament attached to the preceding stubby dilated duct.

Of the cases illustrated, Figure 5 (Case 22) shows the result of a benign fibrous partial stricture following cholecystectomy one year previously. It is to be noted that a much more severe grade of dilatation exists here than in either of the two preceding groups. There is a more abrupt change from the finest terminal ducts to the widely dilated channels of the main trunks, which show beginning saccula-

TABLE III.—DIMENSIONS OF BILIARY TREES IN CASES OF PARTIAL AND COMPLETE STRICTURE OF THE COMMON DUCT

Case	Sex Age	Diagnosis	History of biliary disease	Condition of gall bladder	Obstruction of common duct	Diameter of ducts—mm.							
						Hepatic			Successive branches in descending order				
						Common	Left	Right	First	Second	Third	Fourth	Fifth
22	F46	Benign stricture of common duct	Cholecystectomy 1 year previously; jaundice 6 months	Gall bladder excised 1 year before; multiple stones	Partial	10.	7.5	8.	5.5	3.7	1.6	0.75	0.1
23	F68	Carcinoma of bile ducts	Intermittent jaundice 6 months; attacks of colic right upper quadrant	Gall bladder excised 6 days before; choledochostomy; multiple stones	Complete for 6 weeks	14.	10.5	11.	7.5	6.	4.	1.	0.1
24	M76	Carcinoma of pancreas	Painless jaundice 8 weeks	Distended	Complete for 8 weeks	18.	12.	13.	10.	6.	3.	0.5	0.1
25	M71	Carcinoma of pancreas	Painless jaundice 7 weeks	Distended	Complete for 7 weeks	22.5	13.5	13.	11.	10.5	5.6	1.6	0.2
26	F55	Carcinoma of pancreas	Increasing jaundice 10 weeks; attacks of colic right upper quadrant	Distended	Complete for 10 wks.	30.	20.	16.	13.	8.	6.	1.	0.1

tion of their walls. Figures 6 and 7 (Cases 23 and 24, respectively) represent the biliary trees in two cases of complete malignant stricture, the first of six weeks', and the second of eight weeks' duration. In both, sacculation and varicosity of the ducts are extreme, with well marked clubbing and stubbiness of the branches of the third and fourth orders giving place to the small terminal fifth branches. It is also obvious that as the walls become thin and stretched, they become smooth and lose their parietal sacculi. Nearer the hilus of the liver the main trunks lie close together, entirely dwarfing the portal vein and, indeed, as shown by simultaneous injection of ducts and vein in Case 25, causing stenosis and atrophy of many of its smaller branches, with parenchymal atrophy of the areas supplied.

Figures 8 and 9 (Case 26) show superior and inferior views of a case of complete malignant stricture of the common duct of 10 weeks' duration. Death was caused by acute cholangeitis with multiple abscesses, these being represented by the many small nodules attached to the ducts. The condition is comparable only to hydronephrosis, and in its effect on the parenchyma of the liver is entirely similar. A comparison between Figures 2 and 10 is striking, the average diameter of the common hepatic duct in the latter case being 30 millimeters, and of the branches of the third order 6 millimeters.

DISCUSSION

Until quite recently, dilatation of the bile ducts was considered to be one of the secondary affections of the liver. That it can assume an importance of the first magnitude is nevertheless certain. Weber was perhaps the first to emphasize the relationship existing between this condition and hydronephrosis, and to point out the striking similarity in the associated lesions. On the same basis McMaster, Broun, and Rous, to whom much of our knowledge of the experimental pathology of the liver is due, have proposed the term hydrohepatosis as descriptive of the change. In both conditions, and indeed in conditions of obstruction of the ducts of all secreting glands, secretory stasis, dilatation of ducts, vascular disturbance from collateral pressure, sclerosis, and parenchymatous atrophy are the rule. The process is more marked in the case of the kidney because the secretory pressure is so much higher. Moreover, the slighter degrees of hydronephrosis are more apparent not only on account of the extraparenchymatous situation of the pelvis but by reason of the greater

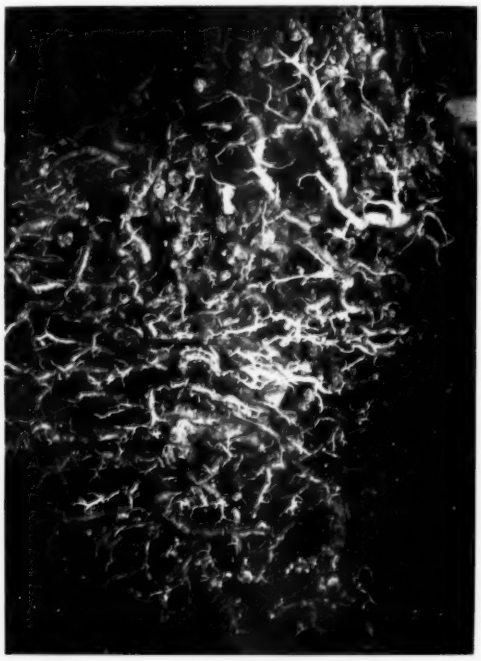

Fig. 8 (Case 26). Superior surface showing complete stricture of 10 weeks' duration, with acute cholangeitis and abscess formation.

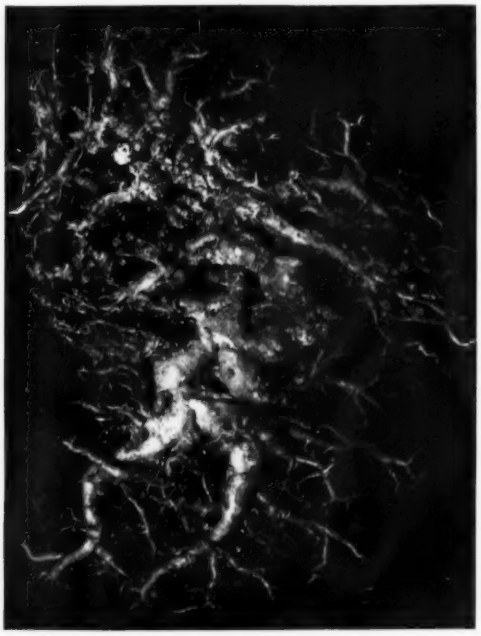

Fig. 9 (Case 26). Inferior surface showing tremendous dilatation of ducts with multiple abscesses.

ratio of duct to secreting tissue. Nevertheless, despite the fact that hydrohepatosis rarely becomes obvious from the exterior, unless it be in the extrahepatic ducts or around the edge of the left lobe, the upset in internal economy is often no less profound.

From a physiological standpoint, McMaster, Broun, and Rous have further classified the condition as concealed or manifest, depending on the concentrating activity of the gall bladder. Provided the gall bladder is functioning, the contents of the duct above the obstruction will be dark and viscid, and the condition will be of the concealed type. If the gall bladder fails to act, or its powers of concentration are lost, then the ducts will contain "white bile" from resorption of pigment and secretion of mucus from their walls. The condition is then spoken of as "manifest." Kausch gave to this the name of hydrops of the biliary system. While it is true that the absence of the activity of the gall bladder is the predominating factor in the production of a so-called manifest hydrohepatosis, there is no doubt that other things must be considered. For instance, the degree and duration of the obstruction, together with the presence or absence of a chronic cholangeitis, will profoundly modify the condition. It seems to us, therefore, that on morphological grounds the term hydrohepatosis as an inclusive one is eminently suitable but that the division into two types is hardly necessary and serves only to confuse the issue. The important point is the obstruction and resultant dilatation by retained secretion rather than its physiological modification by extraneous influences. The two conditions are essentially identical.

A brief review of the various grades and types of hydrohepatosis is desirable here. In the cholelithiasis group, dilatation was mild in 7 cases and absent in one. Little except this slight generalized increase in diameter served to distinguish the ducts from the normal, although the change was, if anything, rather

more marked in the extrahepatic passages. The diminution in diameter was a gradual process not confined to any one particular order of branching. In Case 11 no dilatation occurred and, as we have stated, the gall bladder was apparently in very good condition, even though it contained three small stones. The amount of hydrohepatosis in the other 7 cases was directly proportional to the amount of damage to the wall of the gall bladder, being greatest when the organ had been reduced to a fibrous sac. When cholecystectomy had been performed, hydrohepatosis also occurred but was least marked where a fistula had been established between the gall bladder and the transverse colon. It seems that in this case the drainage either prevented dilatation or caused a return of previously dilated ducts to normal by relief of intraductal pressure.

As is well known, the sphincter of Oddi is the controlling mechanism of the flow of bile into the duodenum. The normal intraductal pressure has been variously estimated from 60 to 70 millimeters of bile with the normal tonus of the sphincter at from 60 to 300 millimeters (1, 5, 11, 13, 15, 32). Judd and Mann have shown that following cholecystectomy the extrahepatic ducts dilate, but that dilatation is prevented by section of the sphincter. Rost finds that dilatation fails when the tonus of the sphincter is low. Bollman, Mann, and Depage have shown that cholecystitis produced experimentally by a specific organism abolishes the concentrating activity of the gall bladder, while Potter and Mann have demonstrated that cholecystectomy following such an infection causes a marked rise of pressure in the common duct. These results have been confirmed by Snell, Greene, and Rowntree from the functional side. It seems, therefore, that the absence of the concentrating and consequently "safety valve" action of the gall bladder either by disease or removal produces a generalized hydrohepatosis, due to the rise in intraductal pressure against the tonic sphincter. Judd has found that at operation this result is constantly seen in the common duct. Our observations tend to show that the process affects the whole biliary tree and that in amount it is directly proportional to the degree of pathological change in the wall of the gall bladder.

In contradistinction to this mild form of dilatation, the gradual partial or complete occlusion of the ducts from stricture produces a most remarkable picture. Here there is a tremendous increase in the diameter of the ducts with stretching and thinning of the walls and consequent obliteration of the pits which form a prominent feature of the normal duct. The process extends more or less uniformly through consecutive branches as far as the fourth and fifth orders. In these situations there is an abrupt transition from dilated to narrow ducts, the actual site of the change depending on the duration and degree of obstruction.

The more severe the hydrohepatosis, the further does this transition extend, and the more marked the appearance of stubbiness and clubbing of the smaller branches. It is obvious that the great increase in size must be accompanied by a corresponding atrophy of hepatic substance, although this is never so marked as to interfere with hepatic function. Hinman and Hepler have shown that ligation of the ureter, together with partial occlusion of the renal vein, is followed by a greater degree of hydronephrosis than simple ureteral ligation. Rous and Larimore (32) have similarly demonstrated the importance of portal blood to the maintenance of the liver. It is interesting to note that in most of our cases the dilatation was more marked and extended further out in the left lobe than in the right. The left branch of the portal vein is long and slender and is given off at a more acute angle than the right. It is probable that the obstruction to the venous flow from lateral biliary pressure produces local parenchymal atrophy and consequently a greater degree of hydrohepatosis in this situation.

Of the conditions producing severe hydrohepatosis, the most important are stones in the common duct, stricture following operative intervention, and neoplastic obstruction. Of these the first and second are of paramount importance to the surgeon. The point to bear in mind is the necessity for early intervention before the condition we have described becomes established with its train of evil con-

sequences in the shape of atrophy, cirrhosis, and chronic or acute cholangeitis. Whether the ducts will return to their original size after drainage we cannot say, although experimental evidence points in that direction.

SUMMARY AND CONCLUSIONS

1. The biliary tree of various types of the liver of man was examined by the celloidin-injection and corrosion method in 26 cases.

2. In ten normal livers the common hepatic ducts were found not to exceed 5 millimeters in internal diameter, while the succeeding branches diminished in size to 0.05 millimeter in the fifth order.

3. Out of eight livers in which the gall bladders contained unsuspected stones, a general enlargement of the ducts was found in seven, the dilatation in the common hepatic ducts being between 6.5 and 11.5 millimeters. The dilatation was greater when the associated damage to the gall bladder was more severe. In the case with no dilatation, the gall bladder contained three small tones but was otherwise apparently normal.

4. In three livers in which cholecystectomy had been performed for cholecystitis with stones, 8, 9, and 10 days previous to death, dilatation occurred in all, but was least marked in a case in which an internal fistula between the gall bladder and colon had been found at operation.

5. In five livers in which benign or malignant strictures of the common ducts existed, the amount of dilatation was very extensive, varying from 10 to 30 millimeters in the common hepatic ducts. The process extended throughout the whole biliary tree, grossly as far as the fifth order of branches. The more complete the stricture and the longer its duration, the farther out the extreme change occurred and the more abrupt was the transition from dilated branches to terminal filaments.

6. The associated atrophy of the hepatic parenchyma resulting from the pressure of the enlarged ducts, the obstruction to the portal venous flow from lateral biliary pressure, and the rapidity with which infection from stasis follows are emphasized.

7. The term "hydrohepatosis" adequately describes the condition.

BIBLIOGRAPHY

1. ARCHIBALD, E. A new factor in the causation of pancreatitis. Tr. Internat. Cong. Med. (Surgery, sect. vii), 1913, xvii, 21.
2. BEALE, L. S. On the Anatomy of the Liver. London: John Churchill, 1856, 80 pp.
3. BOLLMAN, J. L., MANN, F. C., and DEPAGE, PIERRE. The effect of specific cholecystitis on the bile-concentrating activity of the gall bladder. J. Lab. & Clin. Med., 1925, x, 544–547.
4. BRÖDEL MAX. The intrinsic blood vessels of the kidney and their significance in nephrotomy. Bull. Johns Hopkins Hosp., 1901, xii, 10–13.
5. COLE, W. H. The relation of gastric contents to the physiology of the common duct sphincter. Am. J. Physiol., 1925, lxxii, 39–42.
6. FLINT, J. M. The ducts of the human submaxillary gland. Am. J. Anat., 1901–1902, i, 269–295.
7. FORD, W. W. Obstructive biliary cirrhosis. Am. J. M. Sc., 1901, cxxi, 60–85.
8. FRERICHS, F. T. A clinical treatise on diseases of the liver. London: The New Sydenham Society, 1860.
9. GOLUBEW, W. Z. Ueber die Blutgefaesse in der Niere der Saeugetiere und des Menschen. Internat. Monatschr. f. Anat. u. Phys., 1893, x, 541–598.
10. HARLEY, VAUGHAN, and BARRATT, WAKELIN: The experimental production of hepatic cirrhosis. J. Path. & Bacteriol., 1901, vii, 203–213.
11. HERRING, P. T., and SIMPSON, S. The pressure of bile secretion and the mechanism of bile absorption in obstruction of the bile duct. Proc. Roy. Soc. London, 1907, S. B., lxxix, 517–532.
12. HINMAN, FRANK, and HEPLER, A. B. Experimental dronephrosis. The effect of changes in blood pressure and in blood flow on its rate of development and the significance of the venous collateral system. III. Partial obstruction of the renal vein without and with ligation of all collateral veins. Arch. Surg., 1925, xi, 917–932.
13. HINMAN, FRANK, MORISON, D. M., and BROWN, R. K. L. Methods of demonstrating the circulation in general as applied to a study of renal circulation in particular. J. Am. M. Ass., 1923, lxxxi, 177–184.
14. JUDD, E. S. Personal communication.
15. JUDD, E. S., and MANN, F. C. The effect of removal of the gall bladder—an experimental study. Surg., Gynec. & Obst., 1917, xxiv, 437–442.
16. KAUSCH, W. Der Hydrops des gesamten Gallensystems bei chronischen Choledochusverschluss und seine Bedeutung fuer den Chirurgen. Mitt. a. d. Grenzgeb. d. Med. u. Chir., Jena, 1911, xxiii, 138–168.
17. KIERNAN, F. The anatomy and physiology of the liver. Philosophical Tr., London, 1833, cxxiii, 711–770.
18. LEGG, J. W. On the changes in the liver which follow ligature of the bile ducts. St. Bartholomew's Hosp. Rep., 1873, ix, 161–181.
19. LEYDEN, ERNST. Beitraege zur Pathologie des Icterus. Berlin: A. Hirschwald, 1866, 210 pp.
20. LUNDQUIST, L. R., and ROBERTSON, H. E. Technic of mounting specimens in a partial vacuum without fluid. Bull. Internat. Ass. Med. Museums, 1926. (In press.)
21. MACCALLUM, W. G. A Textbook of Pathology. Philadelphia: W. B. Saunders, 1924, p. 328.
22. MCINDOE, A. H. The effects of cirrhosis on hepatic structure. (Unpublished thesis.)

23. McMaster, P. D., Broun, G. O., and Rous, Peyton. Studies on the total bile. III. On the bile changes caused by a pressure obstacle to secretion, and on hydrohepatosis. J. Exper. Med., 1923, xxxvii, 685–698.
24. Mall, F. P. A study of the structural unit of the liver. Am. J. Anat., 1906, v, 227–308.
25. Mann, F. C. A study of the tonicity of the sphincter at the duodenal end of the common bile duct. J. Lab. & Clin. Med., 1919, v, 107–110.
26. Marquis, W. J. Celluloid corrosion preparation of lungs. Bull. Internat. Ass. Med. Museums, 1926. (In press.)
27. Marshall, J. A. Method for preparing blue celloidin injection material. J. Am. M. Ass., 1923, lxxx, 181.
28. Mayer, Heinrich. Quoted by Legg.
29. Potter, J. C., and Mann, F. C. Pressure changes in the biliary tract. Am. J. M. Sc., 1926, clxxi, 202–217.
30. Rost, Franz. Die funktionelle Bedeutung der Gallenblase; experimentelle und anatomische Untersuchungen nach Cholecystektomie. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1913, xxvi, 710–770.
31. Rous, Peyton, and Larimore, Louise D. The biliary factor in liver lesions. J. Exper. Med., 1920, xxxii, 249–271.
32. Rous, Peyton, and Larimore, Louise D. The relation of portal blood to liver maintenance; demonstration of liver atrophy conditional on compensation. J. Exper. Med., 1920, xxxi, 609–632.
33. Snell, A. M., Greene, C. H., and Rowntree, L. G. Diseases of the liver. II. A comparative study of certain tests for hepatic function in experimental obstructive jaundice. Arch. Int. Med., 1925, xxxvi, 273–291.
34. Weber, F. Parkes. Biliary cirrhosis of the liver, with and without cholelithiasis. Tr. Path. Soc. London, 1903, liv, 103–135; also Internat. Clin., 1903, s. 13, iii, 57–87.
35. Winkelstein, A., and Aschner, P. W. The mechanism of the flow of bile from the liver into the intestines: conclusions from previous studies. Am. J. M. Sc. 1926, clxxi, 104–111.
36. Wyss, Oskar. Beitrag zur Histologie der icterischen Leber. Virchow's Arch. f. path. Anat., 1866, xxxv, 553–560.

STRICTURED URETERS, HYDRONEPHROSIS AND PYONEPHROSIS OCCURRING IN CANCER OF THE CERVIX UTERI

Based on a Study of Eighty-Two Cases

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A GREAT impression was made on us in the study of autopsies made upon women dying from cancer of the cervix uteri in which postmortem examination revealed stricture and dilatation of the ureters with hydronephrosis or even pyonephrosis. This, together with papers by Dr. Guy Hunner of Baltimore and Dr. Daniel Eisendrath of Chicago, prompted us to investigate the condition of the bladder, ureters, and kidneys in patients suffering from cancer of the cervix uteri. In all there were thirty-two autopsies performed. Twenty-nine were performed previous to this study and three autopsies were performed on cases included in the clinical study. In an analysis of thirty-two autopsies on patients dying from cancer of the cervix, twenty-one showed gross pathological changes in the urinary apparatus. These were divided as follows: 4 had stricture of the left ureter with accompanying hydronephrosis; 3 had stricture of the right ureter with accompanying hydronephrosis; 10 had stricture of both ureters with accompanying hydronephrosis; 1 had pyonephrosis (no evidence of cancer); 1 had a caseous kidney—no evidence of malignant disease in the pelvis, but metastases in the lungs; 16 showed marked infiltration into the bladder; 3 showed no bladder involvement; but strictured ureters with hydronephrosis; 2 showed bladder involvement, with no hydronephrosis.

As a result of this information we made a clinical study of 50 cases of far advanced cancer of the cervix to determine the frequency with which these lesions occur. It was decided to use cases falling in Group 3 and Group 4. By Group 3 we mean cases in which the lesion involves the cervix with definite evidence of invasion of one broad ligament or beginning invasion on both sides. By Group 4 we mean far advanced cases in which there are definite metastases in both broad ligaments and fixation of the uterus. Fourteen of these

Fig. 1. Case No. 9091. Roentgenogram showing marked dilatation of pelvis and calyces and ureter on right side. Same condition is present on left side but not so marked.

Fig. 2. Case No. 8484. Left side shows all loss of normal relation of pelvis and calyces and dilatation of ureter. There was no dye on this side. The right side also shows beginning of ureteral obstruction.

cases on cystoscopic examination showed definite ulceration and infiltration of the bladder mucosa in the region of the trigone. The remaining 36 cases showed an elevation of the area just beyond the trigone which was covered either with normal mucous membrane or was œdematous in spots. This was regarded as evidence of bladder infiltration which had not progressed to the stage of ulceration. Four of the ulcerating lesions were proved by biopsy. It was thought inadvisable to remove sections unless the mucous membrane was ulcerated. After cystoscopy the capacity of the bladder was measured and then an attempt was made to catheterize both ureters. Kidney function was estimated by phthalein or indigocarmine intravenous injections after catheters were introduced into the ureters up into the pelvis of the kidneys in cases where this was possible. The patient was then removed to the X-ray room where sodium iodide 15 per cent was injected through the catheters and three X-ray pictures made, one with the catheters in place, the second after the injection of the sodium iodide and the third after withdrawal of the catheters, effort being made to take in the whole kidney region, ureters, and bladder, to show strictures in the broad ligament area or at the brim of the pelvis as well as the dilatation of the ureters. The phthalein function was 30 per cent or less in 15 minutes in 8 of 22 cases tested; 14 cases had function varying from 30 to 62 per cent. Five were without any obstructive lesion and the remaining 9 cases showed some evidence of ureteral or pelvic dilatation. It is a noteworthy fact that at the time of injection, those cases that were practically free from stricture and dilatation of the ureter on dilating pelves, complained of more pain in the back and disturbance for 24 hours following than did those in which marked pathology was found. It was rather surprising to find that in 6 cases we were unable to pass a ureteral catheter beyond the strictured area on one side after repeated attempts with catheters varying from No. 4 to No. 6, using at times even a stylet in the catheter. These obstructions occurred most frequently in the lower 2 inches of the ureter.

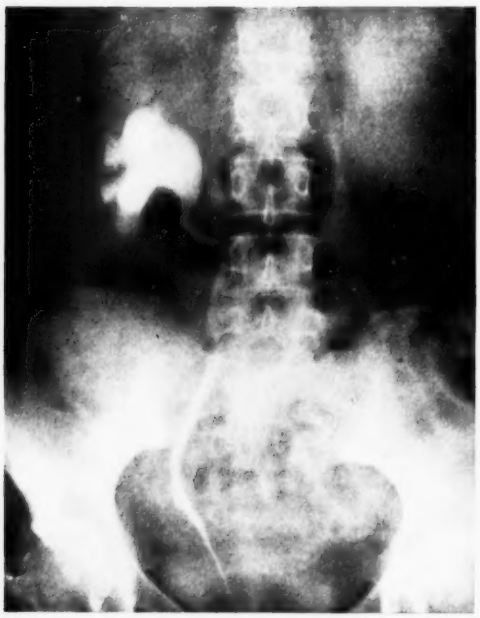

Fig. 3. Case No. 9160. Roentgenogram showing marked dilatation of pelvis of left kidney and dilatation of ureter. Right side was almost totally obstructed, as a catheter could not be passed through the ureter and no dye came through from this side in 20 minutes and in same period function from left kidney was 30 per cent.

Fig. 4. Case No. 9224. Roentgenogram showing marked dilatation of pelvis and ureter on the right side. Six per cent dye in 15 minutes from right side. Catheter could not be passed through ureter on left side and no dye came through from this side. Autopsy 1 month later showed double hydronephrosis.

Twenty-four of the 50 cases showed hydronephrosis or dilatation of the ureters due to stricture of varying degree in one or the other ureter or both. This was divided as follows: left ureter 6, right ureter 11, both ureters 7. This varied from a moderate degree to a marked degree of hydronephrosis with almost total loss of function. These facts were borne out by bimanual examination.

DISCUSSION

In considering these findings the question naturally arose as to what was the cause of the strictures in the ureters resulting in the dilated ureter and hydronephrosis. Is it due to the direct pressure from involvement of the broad ligaments or bladder wall, or is it the result of fibrosis following radiation treatment of cancer of the cervix? It would appear from an analysis of the material studied that this condition existed prior to any form of radiation as well as during the progress of healing, 4 to 8 weeks following radiation or even months after radiation. These cases were routinely treated with tandem tubes of radium in the cervical canal, filtered through 2 millimeters brass and 1 millimeter rubber for a total of 1,200 millicurie hours per tube, supplemented with divided doses of high voltage X-rays so that the total dose approximated 130 per cent, 3 to 5 centimeters from the tubes.

CONCLUSIONS

1. We, therefore, conclude that these strictures are the result of pressure on the ureter from invasion of the broad ligament or bladder wall, which possibly may be made worse as the result of fibrosis in the healing of these lesions.

2. Cases which were classified as Group 3 or Group 4 gave 50 per cent obstruction to ureter, with hydronephrosis or pyonephrosis.

Fig. 5. Case No. 9457. Roentgenogram showing dilatation of both ureters and ptosis of right kidney.

Fig. 6. Case No. 7931. Pyelograms of a Group 4 case which has been clinically well 2 years after beginning treatment. There is some clubbing of the calyces and a little dilatation of both ureters.

3. Even after complete eradication of the disease by radiation, one patient died from kidney insufficiency in which autopsy showed cervix, uterus, and broad ligament areas free from cancer.

4. In all these cases undoubtedly the metastases and infiltration in the broad ligament areas or bladder wall, were responsible for the occlusion of the ureter on one or both sides.

5. So far as we were able to ascertain, there has been no systematic study made of the urinary apparatus with functional kidney tests, cystoscopy and pyelograms in cancer of the cervix uteri.

REFERENCE

SCHREINER, B. F. Clinical results after irradiation of cancer of the cervix uteri. New York State J. Med., 1924, December.

COINCIDENT CANCER AND MELANOSIS OF THE BOWEL

With Report of a Case

By MILES F. PORTER, M.D., Fort Wayne, Indiana

CONSULTING more than half a dozen textbooks on diseases of the rectum and colon, the writer found but one that considered the subject of melanosis of the large bowel and none that said anything about the coincidence of melanosis and tumors as unconnected conditions.

The one author who considers melanosis of the large bowel as a distinct condition is Lynch,[1] who says the disease is comparatively rare.

He credits Peck with having collected 18 cases, and further says that the disease is limited strictly to the mucous membrane, that it is more marked in the cæcum, that it gradually fades toward the rectum, that it begins at the distal surface of the ileocæcal valve, and that the glands are not involved.

In a personal letter, Ewing says: "Melanosis is a rare but well-known complication of tumors of the cæcum and is due to the chronic stasis which arises in some of these cases. It has no relation to melanosarcoma." Ewing has "seen more cases without tumor than with" and thinks that the two conditions in the case herewith reported are "entirely unconnected."

[1] Diseases of the Rectum and Colon, p. 377.

Fig. 1. Drawing showing specimen of melanosis of the bowel.

CASE REPORT

Mr. E., aged 62, came to operation January 2, 1926, with a working diagnosis of ileocæcal obstruction, probably malignant. On opening the abdomen and after releasing adhesions between the omentum, parietal peritoneum, and bowel, we found a tumor of the lower end of the ileum the size of a pullet's egg. About 6 inches each of the ileum and cæcum was excised and an end-to-side anastomosis with the aid of a Murphy button done after we ascertained that there were no glandular, liver, or other metastases present.

On dividing the cæcum I was surprised to note that the mucosa was black. Gross examination of the specimen showed what seemed to be an encircling cancer of the ileum at the ileocæcal junction. There was a general ink-black melanosis of the mucosa of the cæcum.

The appendix was not found, but at what seemed to be the opening of the appendix into the cæcum, there was a small papilloma, part of which was dark red and part black. The mucosa of the ileum seemed normal. The discoloration of the mucosa of the cæcum ended abruptly at the ileocæcal junction. The cut surface of the tumor of the ileum showed no pigmentation (Fig. 1). The melanosis results from deposits of pigment in the subepithelial cells (Figs. 2 and 3). Dr. Ewing suggests that the pigment is "probably derived from some specific bacterial infection." Sections from both the papillary growth (Fig. 4) and the growth in the ileum (Fig. 5) show an absence of pigmentation.

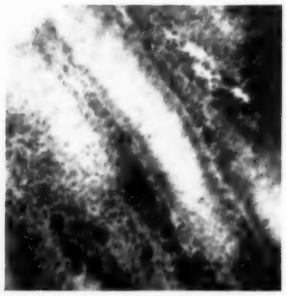

Fig. 2. Melanosis of mucosa of cæcum. Note that the pigment is deposited in the subepithelial cells.

Fig. 3. Melanosis of mucosa of cæcum. Note that the pigment is deposited in the subepithelial cells.

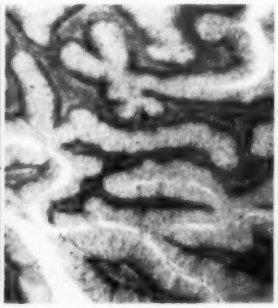

Fig. 4. Section of papillary growth in cæcum. Note absence of pigment. Gelatinous adenocarcinoma.

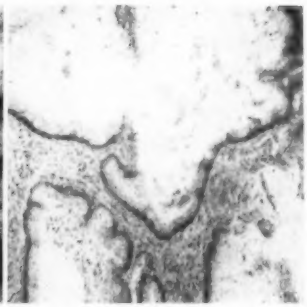

Fig. 5. Section of the growth from the ileum. Note absence of pigmentation. Gelatinous adenocarcinoma.

The specimen was examined in three different laboratories and all the pathologists agreed on the diagnosis of "gelatinous adenocarcinoma." Dr. Ewing's first report on the specimen was not quite clear to me on some points so I wrote asking him to clear them up. He very kindly replied as follows:

"I could not clearly identify all the structures in the bowel tumor specimen. The main tumor projects as a papillary mass into the large intestine. It involves the wall of a small segment of ileum, but appears to lie outside of the ileum since the mucosa in this segment is unaffected. Since I could not find the appendix, I concluded that the tumor must arise in the appendix and that the ileum entered at another point. The specimen does not reveal whether the ileum enters the resected bowel.

"Your own observations can best determine whether the tumor surrounded and occluded the ileum. If it did, then the tumor was primary in the ileum. I cannot prove this from examination of this material. I made a section from the whole wall of the tumor. The papillary growth is merely an extension of the main tumor. There are not two tumors, but only one. It seems most probable that the tumor is primary in the ileum at the entrance into the cæcum.

"I think that the tumor itself has been fully removed so far as one can see. Terms of colloid carcinoma and gelatinous carcinoma carry identical meaning."

When the melanosis was first disclosed to the operator at the time the bowel was sectioned, he having in mind melanosarcoma, thought he was doing a futile operation, but on closer examination of the specimen and especially after getting the reports from the pathologists to the effect that the melanosis and malignancy were distinct processes and that the carcinoma "seemed to be fully removed" he concluded that his patient had a good chance for a temporary cure and an ordinary chance for a permanent cure.

It should be added that up to the present, the patient's condition is entirely satisfactory.

HEMIHYPERTROPHY

By LAURENCE H. MAYERS, A.M., M.D., Chicago
From the Medical Service A, St. Luke's Hospital

An interesting and classical picture of the rare anomaly of development known as hemihypertrophy is offered in this report with accompanying photographs of E. H., a girl of 9 years who appeared December 7, 1925, as a patient at the Outpatient Department of St. Luke's Hospital for examination into causes of a vague chest pain experienced after strenuous exercise and signs of early fatigue, noticeable particularly on the left side.

The entire right side of this patient participates in an enlargement involving subcutaneous tissues, muscles, and bones. The condition was apparent at birth. It has been nonprogressive and the symptoms for which it has been responsible have been mechanical rather than organic or functional in type.

Hemihypertrophy, though readily recognizable, is by no means simple of explanation. The lateral asymmetry of form may be so definite as to affect the tongue and neck, and it may involve imbalance of all the paired organs, both internal and external. The dissimilarity of the two sides of the face may be so striking as to suggest that the opposite sides really should belong to different persons. Indeed, Arnold Gesell advances the opinion that the anomaly differs only in degree from certain aberrations in the twinning process which at one extreme produces two separate beings at a single birth, but which under normal conditions is limited to the normal pairing noted in all bilateral organisms.

The forty cases of true hemihypertrophy which have found a place in medical literature and the thirty other reported cases of partial or crossed hypertrophy have been the source of so much medical speculation that it has seemed worth while to investigate with painstaking zeal the case herein reported. Precise physical measurement, therefore, has been supplemented by a much more extensive family and personal history than accompanies the early recorded cases, and also the full resources of the laboratory have been utilized to bring out any possibilities of obscure disorder or functional imbalance that could properly be ascribed to the dystrophy shown. By such careful method we may safely state that E. H. is in good health; that her left side is normal for a girl of 9 years; and, that the right-sided enlargement is the only anomaly shown. This is to say that the findings throughout indicate a case of true hemihypertrophy.

Physical examination shows E. H. to be intelligent, fairly well nourished, and apparently in good health. She is active at play and enjoys it, though on her own statement her endurance is less than that of other children of her own age. The right side is less agile than the left, and sensations of heat and cold are exaggerated on the left side. Vision, hearing, taste, and other sensations are normal, but her mother reports the occasional sudden appearance of ashy paleness without any acknowledged concomitant physical discomfort. She sleeps well, has had no headaches or other unfavorable symptoms, other than some shortness of breath after strenuous exercise. Reflexes and other functions are normal.

There is a marked disproportion in the two sides of her body. The left side is apparently normal in size for a girl aged 9. The entire right side of the head, face, neck, chest, arm, and leg, are noticeably larger than the left. The height of the two shoulders is about equal, but the difference in the length of the leg on the right side causes the crests of the ilia to assume different levels and a slight scoliosis is the result. The disproportion in the two sides is much greater in the face and below the crests of the ilia than in the arms and chest. The two hands are equal in size. The eyes are round and of equal size, but the nose is somewhat displaced laterally and the ala is prominent on the right. The right auricle is much larger than that on the left. Muscular disproportion is noticeable in the neck. The

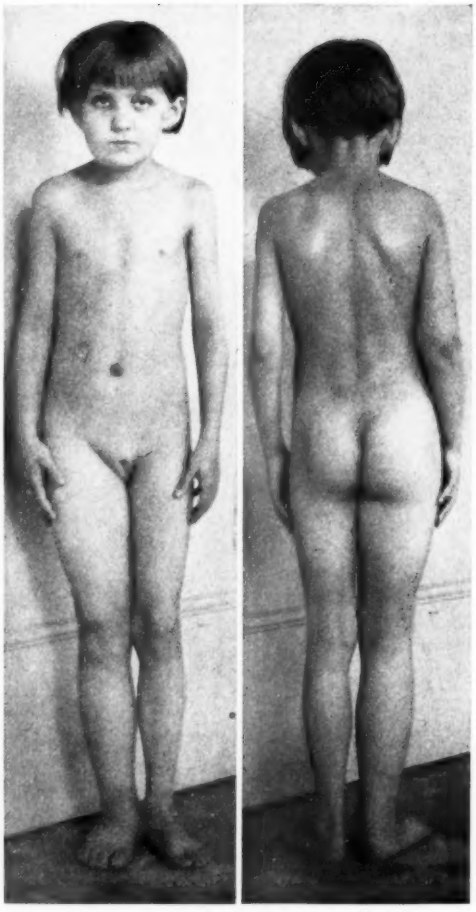

Fig 1. Front and back views of patient.

right foot is full and thick and exhibits an unusually high arch.

The hair on the right side of the head is slightly coarser in texture than that on the left. The skin is thicker on the right side and rather resembles a scleroderma. It is especially thick and hardened in the legs and feet, is paler in color on the right side, and this region perspires profusely and emits a peculiar odor. The skin is free from eruptions, and there is no sign of the pigment changes or nævi which some authors consider characteristic of hemihypertrophy.

Fig. 2. Composite roentgenogram of bones of patient's body. The bones everywhere participated in the right-sided enlargement, proving that the overgrowth extended to all tissues of mesoblastic origin.

No unusual factors are forthcoming in family or personal history which would throw any light on the cause or course of the condition. The entire right side was noticeably enlarged at birth. The rate of growth has been the same on both sides, and the disparity has not increased. The comparative measurements are as follows:

BODY MEASUREMENTS

Weight	55 pounds
Height	50 inches
Span	123.5 centimeters

Head	Centimeters
Fronto-occipital	52.5
Superior maxilla	48.0
Inferior maxilla	44.0
Occipitomental	46.0
Verticomental	58.5
Neck at thyroid	26.5

Arm	Centimeters Right	Left
Arm at insertion of deltoid	18.0	15.5
Forearm—upper third	18.0	16.0
Forearm—middle	14.0	14.0
Wrist	12.5	12.0
Metacarpophalangeal joints	14.0	14.0
Acranium to olecranon	26.0	25.5
Olecranon to styloid	18.5	18.25
Styloid to tip middle finger	15.0	16.0
Chest at second rib	62.0	58.0
Chest at ensiform	55.0	
Abdomen at umbilicus	54.5	
Abdomen at trochanter	65.5	
Thigh		
Upper one-third	41.5	35.5
Lower one-third	32.5	26.5
Mid-calf	28.0	24.0
Ankle above malleolus	19.75	15.75
Across instep	21.0	18.0

Elaborate and painstaking laboratory investigation revealed nothing abnormal or in any way unusual in metabolic rate, regional temperatures, blood findings, or urinary function. Under X-ray examination, the bones are shown to participate everywhere in the right-sided enlargement, and proved the prediction that the overgrowth extended to all tissues of mesoblastic origin, namely, the subcutaneous tissues, muscle, and bone.

This case is a noteworthy example of true hemihypertrophy in contradistinction to similar conditions of partial or crossed cases involving one or more members, or enlargement of the face with corresponding enlargement of members on the opposite side of the body. No evidence is adduced to show that all paired organs share in the disproportionate development in this case, but it is probably no exception in this matter or in the fact that the hemihypertrophy is in direct relationship to the dominant cerebral hemisphere.

No evidence of mental inferiority in this case bears out the thesis of Arnold Gesell that hemihypertrophy should categorically be linked with mental inferiority, but the nervous tendencies noted suggest that right-sided hypertrophy in the cranium may conduce some nerve disequilibrium. Other physical and laboratory findings are in general negative.

The forty cases of true hemihypertrophy reported in the literature and the thirty other partial or crossed cases show a preponderance of males and a predilection for the right side. Only five true cases occurred in adults and the data in the series as a whole are incomplete and unsatisfactory as to the mental status of the patients. Many of them were children in whom mental deficiency signs might not be very apparent. Few reports give consistent clinical findings other than physical measurement. Only one case in the literature carries the statement that the condition was progressive. All evidence goes to show that hemihypertrophy is congenital in origin, having as its basis a defective anlage. It is not progressive and is not in itself a stigma of degeneracy.

Its course and congenital origin are in distinct contrast with the dystrophies marked by abnormal disposition of fat, cerebral or glandular in type and always of post-natal origin. Arnold Gesell's inclination to find an analogy between the general asymmetry of hemihypertrophy and the known relationship between right-sided cranial enlargements and feeblemindedness is well supported in his able discussion of the biological process of twinning, which underlies the evolution of paired organs. It is impossible to postulate the particular varieties of influences which operate as early as within the first 4 weeks after impregnation, or perhaps within the ovum itself, to give one side of the human body a growth advantage over the other; but any advantage so acquired is never lost. The case of Gotch, according to Gesell, had a growth advantage

of a year beyond that of the opposite side as measured in terms of erupted teeth. Many and various causes may induce this particular type of developmental anomaly, but the result in every case has been the breaking down of some inhibition to growth, and the cells continue to go wild thereafter.

No human being is exactly the same on both sides and seemingly insignificant discrepancies of this kind, according to H. H. Newman, may account for many personality deviations as well as physical imbalance. In this connection he makes the significant observation that growth retarding agents may be utilized in experimental work to produce in embryonic fish specimens characterized by rapid growth on one side, which results in curved and spiral variations in form. Thus he postulates that a very slight isolation in early embryonal life may produce a one-sided growth advantage that remains permanent in the human form. He is in agreement with Arnold Gesell that the twinning process in bilateral organisms is open to many conditions that make for imbalance and the wonder is that we encounter hemihypertrophy so seldom.

Routine medical histories taken along conventional lines with the purpose in view of proving the presence of disease are not sufficient to clear up questions involving developmental anomalies that influence individual constitution. Morphogenesis increasingly enters into questions of diagnosis. The mechanism of growth cannot be considered apart from diathesis, and personality deviations, too, need to become in every case an integral part of clinical observation.

BIBLIOGRAPHY

1. Bassoe, Peter. Unilateral hypertrophy involving the entire left side of the body. Am. J. Insanity, 1912, lxix, 91.
2. Idem. Endocrinology and Metabolism. New York: Appleton, p. 837.
3. Gesell, Arnold. Hypertrophy and mental defect. Arch. Neurol. & Psychiat., 1921, p. 400.
4. Hassan. Abt's Pediatrics, vii, pp. 321 and 324.
5. Lisser, H. Congenital total hypertrophy. J. Am. M. Ass., 1924, lxxxii, 1046.
6. Lustberg. Persistent congenital hypertrophy of the right lower extremity. Arch. Pediat., 1912, xxxix, 662.
7. Mohr, G. J. Complete left hypertrophy. Arch. Pediat., 1925, lxii, No. 5, 330.
8. Reed, A. C. Congenital total hypertrophy. New York M. J., 1923, cxviii, 483.
9. Newman, H. H. Hemihypertrophy—the Physiology of Twinning. University of Chicago Press, 1923, p. 159.
10. Stanton, James N., and Tuft, Louis. Congenital total hypertrophy. J. Am. M. Ass., 1923, p. 1432.

TRAUMATIC PNEUMOCEPHALUS

An Analysis and Report of a Case[1]

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THE presence of air within the cranial cavity, the result of injury, has been brought to our attention in recent years with increasing frequency. Hydropneumatocele, hydropneumocranium, traumatic pneumocele of the ventricle, aerocele of the brain, traumatic pneumoventricle and pneumocranium are terms used, sometimes without discrimination, to describe the condition. A simpler and better term would be pneumocephalus. Hydrocephalus (water-head) is not only descriptive of a condition, but it was also a familiar word hundreds of years before the pathology of the condition it described was known. The replacement in part of fluid by air in the cranial cavity should make the use of the term pneumocephalus preferable. Moreover we find hydrocephalus divided into two classes; the internal and external hydrocephalus in accordance with the location of the massive fluid collection. A similar disposition is found to exist with air collections which may with equal propriety be designated as internal and external pneumocephalus. This arrangement should serve to co-ordinate and simplify a terminology which seems at present to be running wild.

CASE REPORT

T. J. F., male, age 60, referred by Dr. H. S. Gilmore of Owingsville, Kentucky, entered Good Samaritan Hospital on July 8, 1925. On May 18 patient was kicked in the head by a mule. He says he was not wholly unconscious and started to walk to the house, but became sick and was carried in. The accident occurred about 2 p.m. and until 11 p.m. he bled from the nose in a steady stream. During this time he vomited blood frequently. The eyelids swelled and there was ecchymosis. There was some blood from the right ear. The conjunctivæ were never suffused with blood. The right eye was involved first, then the left. The swelling lasted about 1 week. The patient was in bed for 3 weeks, and during this time was clear mentally and showed no loss of memory. He had no paralysis or twitching, but he complained of severe headache.

After 3 weeks he got up and was up for 2½ weeks. During this time the headaches persisted and became progressively worse. Occasionally he spat up a little blood. He sneezed and coughed some at various times, but had no bad coughing spells. Three weeks prior to admission he had such severe headaches that he went to bed. The pain was worse in the back of the head. After being in bed 3 days he had a profuse discharge of clear fluid, estimated at about a pint, from his nose and with this discharge the headaches were relieved. From this time also he would void and defæcate involuntarily and his mental processes became clouded. The condition has not changed since first discharge of fluid from nose.

Physical examination showed nothing abnormal in the skin, thyroid, peripheral arteries, heart, lungs, abdomen, liver, kidneys, spleen, spine, joints, and extremities. There is a depressed fracture of the right frontal bone over the right eye extending vertically 1½ inches. Clear fluid drips from the

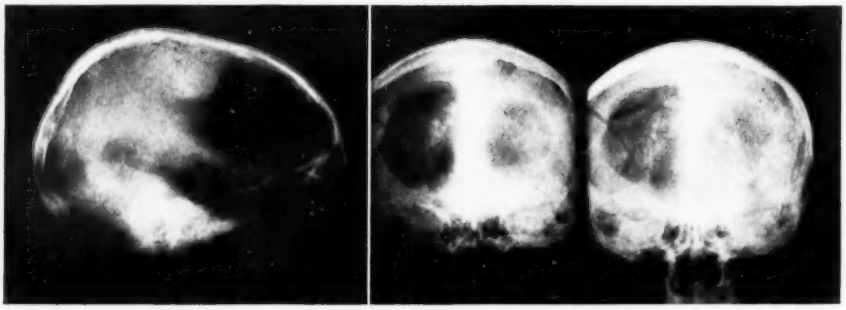

Fig. 1. Lateral and anteroposterior roentgenograms of author's case.

[1] Submitted for publication, February 17, 1926.

nose when patient assumes sitting position—amount 2 to 3 ounces.

X-ray examination July 8, of the skull shows that there has been a fracture of the right side of the skull. The fracture line extends through the base of the nose and lateral side of the orbit up the frontal bone just in front of the coronal suture. The character of the fracture suggests that the patient was struck with a sharp instrument and air has been introduced into the cranial cavity and into the ventricles which are beautifully outlined. (Jno A. Herring.)

Neurological examination reveals a well developed and nourished male. No anæmia or jaundice are present. He has a slight exophthalmus. The pupils are contracted, equal, and respond promptly to lights. Ocular movements are limited upward and laterally. No increased ocular tension is found. Patient presents mild confusional psychosis; is not oriented for recent events or time. Speech is slow and hesitating. General muscular co-ordination is only fair. Tactile sensation is probably normal but lack of co-operation makes test doubtful. Pain and temperature sense is normal. Hyperæsthesia of extremities is increased. The patellar reflexes are markedly exaggerated; no Oppenheim or Babinski sign; no ankle clonus. He has incontinence of urine and fæces. Spinal fluid is under no pressure so that position and forced breathing was necessary to obtain specimen. (C. N. Kavanaugh.)

Laboratory examination of spinal fluid, July 11, 1925 showed: Amount, 13 cubic centimeters; appearance, slightly turbid; globulin, 1 plus; cell count, 13; mononuclears 13; bacteria, none; culture, no growth; Wassermann, negative.

Fluid from the nose added in doubled amount to Benedict's solution produced a slight reduction.

Eye, ear, nose and throat examination showed pupils contracted, limited ocular movements to left and no upward movement of eye balls, fundus negative. The ear drums were all right. Clear water fluid was collected from the nostrils but we were unable to tell from what part of nasal fossa it comes. The naso-pharynx is negative. (W. J. Greenfield.)

Operation was done July 12—exploratory craniotomy and puncture of ventricle. A skin flap was made over the depression. The depressed portion of the bone was removed. The dura was loose and flaccid. There was no evidence of any intracranial pressure; indeed, the reverse was the case. Inasmuch as there was a space between the dura and the brain extending around the frontal lobe, the brain itself seemed to fall and rise with each respiration. A small trocar was pushed through into the ventricle, but there was no difference in pressure and no air escaped. The wound was closed leaving a small rubber tissue drain.

Progress: July 16, some reddish œdema was present about the right lids. Patient voids involuntarily. Temperature is 99.2 degrees.

July 17, patient is very restless, getting out of bed. Axillary temperature is 100.2; pulse, 120-130; He does not swallow food, but holds it in his mouth.

July 20, condition continues about same, but patient is weaker. He is delirious, getting up from bed. The reflexes are exaggerated—hypersensitive. Rigidity of neck and back are present; meningitis (?). Temperature 99 to 101.8; pulse, 70 to 128; respirations 22–34.

July 21, patient's condition is much worse. The eye is congested, with rotary nystagmus. Temperature is 102 plus. Unconsciousness persists.

July 22, expired at 1:10 a.m. Post-mortem examination was not permitted.

INCIDENCE

Luckett (9) reported the first case in 1913 under the title, "Traumatic Pneumoventricle"; Grant (5), in 1923, reported a case and presented a review and tabulation of 10 cases. The present paper is based on a study of these 11 cases plus a second case of Luckett's (10), one by Sir William Wheeler (18), one by McCannel (12), one by Teachenor, (17), and the one here presented (Case 16).

Potter (13) says: "It is probable that many cases of intracranial air are overlooked because of the infrequency of roentgen-ray examinations 2 to 3 weeks after the injury when pneumatic sinuses are fractured into." While this may later be shown to be true, there is little in the facts developed by this study to justify its general acceptance.

MECHANISM

The manner in which air enters the cavity of the brain is still conjectural to a large extent. It has been suggested and quite generally accepted that it reaches the inside of the cranial cavity by being forced up through the fractured sinuses of the frontal bone, the ethmoid or the sphenoid, by the acts of sneezing, coughing, or blowing the nose, and since the majority of reported cases show fractures through the frontal and ethmoid cells, and since the larger number of air pockets occupy the frontal region, this seems the most reasonable explanation. There are, however, cases in which the injury has been in the parietal region. Cases 11 and 9 of this series show injury in such a location. The above explanation would not hold to account for the presence of air in these cases. It is pos-

No.	Author	Air on First Exposure	Time of First Appearance	Outstanding Symptoms	Op.	L.	D.	Cause of Death
1	Luckett	No	28 days	Pressure	Yes		D.	Meningitis.
2	Potter	Yes	19 days	None	No	L.		
3	May	Yes	Immediately	Fatal	No		D.	Trauma.
4	Skinner	Yes	4 weeks	Headache and dizziness	Yes		D.	Meningitis.
5	Holmes	Yes	Immediately	Meningitis	Yes		D.	Meningitis.
6	Horrax	Yes	1 month	Altered mental state. Right sided weakness. Anosmia.	No	L.		
7	Doyle	Yes	2 mos. 26 d.	Pressure	Yes		D.	Cerebral path.
8	Cotte	?	9 months	Persistent cerebrospinal fluid from nose	No	L.		
9	Imboden	No.	32 days	Epileptoid	No.	L.		
10	Glenard and Aimard Barbe and Glenard	?	2 months	Persistent cerebrospinal fluid from nose	No	L.		
11	Luckett	Yes	32 days	Dizziness and confusion	Yes	L.		
12	Grant	Yes	1 day		Yes	L.		
13	Teachenor	Yes	Immediately	Mental confusion and muscular weakness	No	L.		
14	Wheeler	No pictures	Immediately	Pressure	Yes		D.	Meningitis
15	McCannel	No	3 weeks	None	No	L.		
16	Bullock	Yes	1 mo. 20 d.	Persistent cerebrospinal fluid from nose	Yes		D.	Meningitis

L. Lived. D. Died.

sible that following a fracture through the petrous portion of the temporal bone opening into the tympanic cavity, the patient by the expulsive efforts above mentioned or in his stertorous efforts at respiration might force air back through the eustachian tube into the middle ear and thence into the cranial cavity. Nor do either of these explanations fit the cases in which air is found in the cranial cavity immediately following the accident as occurred in several of this series. To account for the condition under these circumstances we may assume that as a result of the sudden application of force to the skull there is in some way produced a certain degree of negative pressure within the calvarium, and that into this vacuum there is aspirated ahead of the expanding brain, a certain amount of air at the time of its occurrence or within a short time thereafter.

TIME OF APPEARANCE

It seems to be the general impression among those who have written on the subject that the presence of air within the skull does not follow immediately after the accident, but that it makes its appearance after a period from 2 to 3 weeks. We find in this series that air was definitely present.

	Number of cases
Immediately or within 24 hours	5
In 19 days	1
In 21 days	1
In 28 to 32 days	5
In 60 to 90 days	3
In 9 months	1

We find that air was definitely present on the first X-ray films in 10 cases; that air was definitely absent on first plates in 3 cases; that in 2 cases the record is silent on this point; and that in one case no plates were made. That is to say, that with few exceptions the early plates showed the condition early; the late plates showed the condition late, or in other words it is the recognition of the condition rather than the condition itself that appears late, and there is reason to believe that a more careful study of early plates will be more enlightening in determining the diagnosis than later ones.

CLASSIFICATION

From a study of the assembled films it is not difficult to note that there are three distinct forms of pneumocephalus.

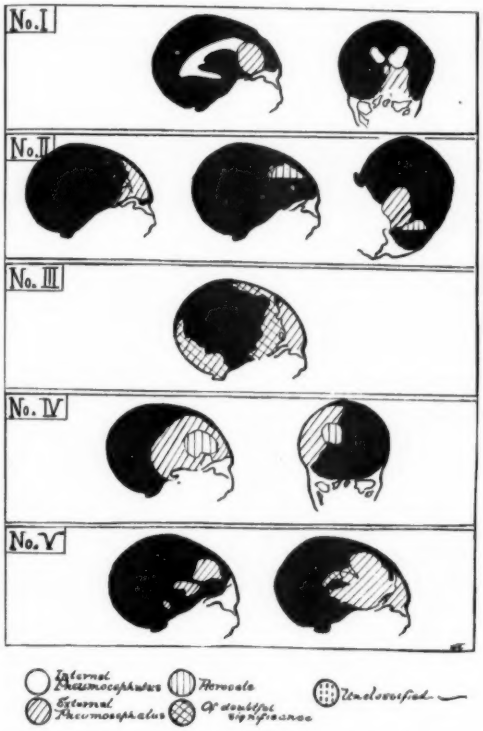

Fig. 2. Drawings of roentgenograms in Cases 1 to 5.

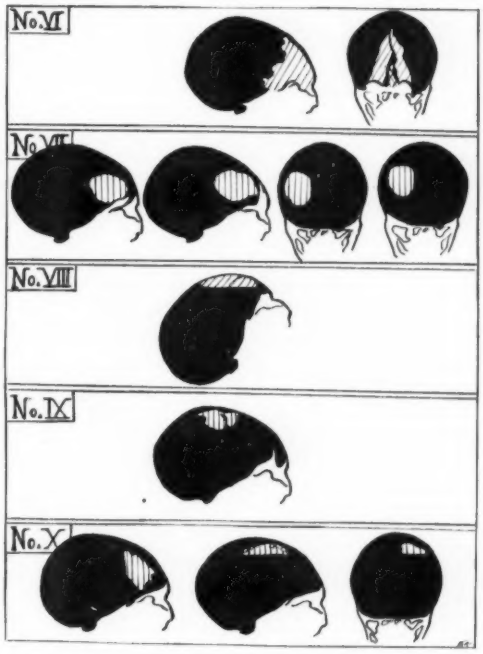

Fig. 3. Drawings of roentgenograms in Cases 6 to 10.

1. The diffuse subdural type, external pneumocephalus. This appears on the plates as an area of diminished density usually without definite outline and as a rule the ventricle are not visualized. This type is the primary stage in the formation of both the other two types. The pneumocephalus in this form may be limited to the immediate region of the fracture as in Case 6 in which it seems to have passed for a short distance between the cerebral hemispheres. It may spread itself out over the side of the brain as in Case 3, or it may form a large air cap covering the convexities of the frontal lobes, Cases 8 and 16.

2. The pneumoventricular type, internal pneumocephalus, in which the ventricles are filled with air and usually distended and distinctly outlined on the film. This type may occur alone or in combination with Type 1. From the fact that to reach the ventricle air must pass through the subdural space, pure internal pneumocephalus of traumatic origin exists only after the subdural air has been completely absorbed. The access of air to the ventricle may be direct through the damaged frontal lobe which closes valve-like after admitting the air and letting out the fluid. The access of air into the ventricle may, on the other hand, be indirect through a rent in the arachnoid passing through the cisterna magna, the foramina of Mangendie and Luschka through the iter and the foramen Monro. Certainly in some of the plates the region of the cistern stands out with great distinctness, although this may be an artefact. A possible route is mentioned by Teachenor as being through a rent in the floor of the third ventricle at the postchiasmal space.

3. True aerocele, a circumscribed accumulation of air within the brain itself. Here, as in the preceding type, external pneumo-

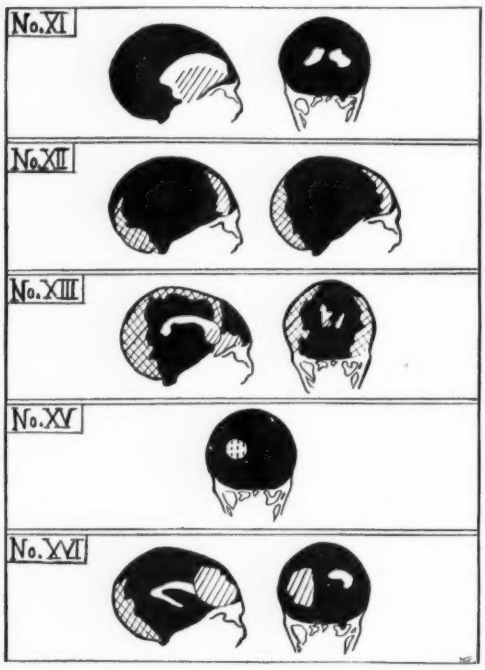

Fig. 4. Drawings of roentgenograms in Cases 11, 12, 13, 15 and 16.

cephalus is the primary stage. The trapped cushion of air is compressed between the brain and the dura. If the brain is uninjured the condition is static, but if laceration of brain is concomitant, the compressed air enters the hiatus, displaces the damaged brain tissue, and forms for itself a lodging place, the extent of which corresponds to the extent of brain damage (Spiller) and to the degree of pressure. The development of air cysts, the subsequent conversion into true cysts by replacement of air by fluid, the microscopic study of postmortem condition, was first described by Barbe and Glenard (1) and by Glenard and Aimard (4). Spiller (15) has contributed to the knowledge of the subject reporting his postmortem findings on a similar case. Quoting Glenard and Aimard (4): "It can be said that the walls of the aerocele are formed going from the superficial to the deep, first by a thick membrane analogous to the ventricular ependyma, then by a zone of sclerosis and lastly by fibers having the appearance of normal myelinization." Spiller (15), however, found no such ependymalike membrane lining the cyst wall. After existing for variable periods, the air in the aerocele may be gradually replaced by fluid. On the other hand, from the histories that have been submitted, it is quite evident that some of the cases of aerocele resolve themselves by gradual absorption of the air and its replacement by brain tissue. The manner in which resolution of aerocele of the brain takes place will probably be found to depend upon the presence or absence of adequate communication between the air pocket and the subdural space or, possibly, the ventricular space.

When the air in these air cysts is partially replaced by fluid, the roentgenogram shows a very definite water line, which changes its position according to the position of the head. The diagnosis of aerocele of the brain may be made only when the stereoscopic roentgenogram shows a distinct cavity within the brain itself or when flat plates in two directions show a limited, well defined cavity within the brain. Not all the cases of intracranial air which show a definite water line are to be interpreted as aerocele. I regard Case 8 as one of subdural type.

In Case 16 operation was carried out partly on the mistaken interpretation of the plates by the roentgenologist. The anteroposterior views in this case seemed to show a greatly dilated ventricular space, the lateral view seemed to show an aerocele. Upon opening the skull, however, we found that there was no dilatation of the ventricles, there was no aerocele of the brain, and that the area of diminished density was due entirely to an air cap surrounding the convexities of the frontal lobes. Had a roentgenogram of this case been taken from side to side with the face up, it would have shown a water line similar to that in Case 8.

The cases herewith are analyzed and classified as follows: external pneumocephalus, Cases 3, 5, 6, 8, 12 and 14; internal pneumocephalus (pure), none; aerocele of brain, Cases 2, 4, 7, 9 and 10; combined internal and external pneumocephalus, Cases 1, 11,

13 and 16; unclassified because of insufficient data, Case 15.

TREATMENT

From a consideration of the operative results, it is evident to the most complacent that surgical attempts to relieve this condition have been either unnecessary, inopportune, improper, or insufficient. Spiller (15) says: "The question of operation is a difficult one. If it is to be performed early, it will be before any evidence of aerocele exists, and will be done in the hope of preventing this lesion. It is not customary to operate on every case of linear fracture of the skull without displacement of fractured bone and without signs of intracranial pressure, and it seems questionable whether operations would be advisable wherever the roentgen-rays show a linear fracture permitting communication with air sinuses. In some instances it is difficult or impossible to be certain from roentgen-ray examination whether an air communication with the interior of the cranium has been established. Presumably where such communication is shown by roentgen-ray plates taken shortly after fracture has occurred, operation might make closure of this communication possible and thus prevent the development of an aerocele, and the possibility of the development of an aerocele must be considered in every case of fracture of the bones about the nose. It would be difficult to prevent the patient from blowing the nose and sneezing in the presence of such fracture, but something might be attempted in this direction to lessen the danger."

Grant (5) says: "The presence of a pneumocranium immediately after the injury is an indication for operation at once to attempt to close the dural tear, thus minimizing the danger of infection. If the air is unexpectedly discovered after 5 or 6 days, when the sinus may have spontaneously closed, and if on repeated X-ray the quantity of air shows no increase and is causing no symptoms, a policy of watchful waiting should be instituted. Air *per se* once the possibility of infection can be excluded is relatively innocuous; it will be absorbed and no harm result. The patient should be warned against coughing or sneezing, which might reopen the sinus and force more air into the subdural spaces. Urotropin should be administered. The nose should be douched gently with a weak antiseptic solution."

Wheeler (18) says: "In view of the high mortality from infection to the meninges in fractures of the base of the skull communicating with the external air, and notwithstanding the general trend of opinion in favor of operation, it seems questionable whether treatment along conservative lines would not be followed by better results. Prophylaxis in the form of careful attention to the orifice through which blood and cerebrospinal fluid are escaping, and the administration of urotropin and its derivatives, will tend to prevent infection better than drainage."

Unquestionably, whenever signs of pressure arise in these cases, relief of pressure is indicated, but the methods hitherto proposed and carried out seem to favor the development of meningitis.

Of the 8 cases in which no operation was done, there were 7 recoveries (one of these was already dead when the plates were made). Of the 8 cases in which operations were performed, there were 2 recoveries. This comparison is not altogether fair because certainly two of these latter would have perished had no effort been made to save them, and the symptoms in others were more or less urgent. However, upon closer inspection we find that in Cases 1, 4, and 14, there was immediate improvement following operation, to which there succeeded after an average interval of 10 days, meningitis and death. Of the other fatal cases, Cases 5 and 16 died of meningitis and Case 7 died as the result of cerebral disease. Of the cases operated on which recovered, Case 12 recovered apparently in spite of, rather than because of, operative interference, and Case 11 appears to be the only case of recovery in which relief may reasonably be attributed to the operation, and in this case, according to Holmes, brain abscess subsequently developed.

The explanation of the sequence of improvement followed by meningitis may be interpreted as follows: The operation

secured decompression; the air within the cranium, while not germ free, did not contain sufficient organisms to set up inflammatory reaction; the superimposed trauma of the operative procedure with its accompanying devitalization of tissue and local reaction was just enough to start the conflagration.

We may assume that no operation of any kind should be done unless symptoms referable to intracranial pressure develop; that in these latter cases decompression should be done with the least possible trauma. To decompress a toy balloon requires but the prick of a pin. In traumatic pneumocephalus with increased intracranial pressure, we have a toy balloon, the coverings of which are the walls of the skull, the scalp, and the dura. A small incision through the scalp, a drill hole through the bone, and a small hollow needle through the uncut dura into the air pocket will secure the desired effect, be the accumulation subdural, within the brain, or in the ventricular cavity. Aspiration should not be necessary, for air not under pressure will not produce symptoms and will be rapidly absorbed.

I believe that efforts directed toward closing the portal of entry of air are not only useless, but actually harmful on account of the trauma that must necessarily accompany such effort. Even in those cases in which there is persistent discharge of cerebrospinal fluid from the nose, of which there were three in this series, in whom the condition persisted for more than a month, in none of these cases did meningitis develop except in Case 16, when it followed operative opening of the skull. While I do not look upon a persistent fistula of this kind as harmless, I do believe its danger is greatly increased by surgical interference. Where active meningitis has already developed to a sufficient extent to warrant interference, surgery along established lines may be of service.

In the case here detailed I feel that the operation done calls for a plea of guilty on three counts; namely, it was inopportune, unnecessary, and improper, but this opinion was formed only after a careful study of all the literature on the subject.

For the purpose of showing the different types of the condition, the hitherto reported cases are reproduced diagrammatically.

BIBLIOGRAPHY

1. Barbe and Glenard. Press méd., 1919, July 7, 376.
2. Cotte. Bull. et mém. Soc. de chir. de Par., 1917, xliii, 865.
3. Doyle, A. S. Am. J. Roentgenol., 1921, viii, 73.
4. Glenard and Aimard. Presse méd., 1919, Mar. 10, 1923.
5. Grant, Francis C. Surg., Gynec. & Obst., 1923, xxxvi, 251.
6. Holmes, G. W. Am. J. Roentgenol., 1918, v, 384.
7. Horrax, G. Ann. Surg., 1921, lxxiii.
8. Imboden, H. M. Am. Atlas of Stereoroentgenology, vol. ii.
9. Luckett, W. H. Surg., Gynec. & Obst., 1913, xvii, 237.
10. Idem. Surg., Gynec. & Obst., 1917, xxiv, 362.
11. May, R. J. Am. J. Roentgenol., 1919, vi, 123.
12. McCannel. Laryngoscope, 1923, xxxiii, 189.
13. Potter, H. E. Am. J. Roentgenol., 1919, vi, 12.
14. Skinner, E. H. J. Am. M. Ass., 1916, lxvi, 954.
15. Spiller, W. G. Med. Clin. N. Am., 1921, v, 651.
16. Stewart, W. H. Am. J. Roentgenol., 1913, i and ii, 83.
17. Teachenor, F. R. Ann. Surg., 1923, lxviii, 561.
18. Wheeler, Sir Wm. The Lancet, 1923, cciv, 529.

CARCINOMA OF THE SMALL INTESTINE

Report of a Case of Carcinoma of the Ileum

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THE rarity of carcinoma of the small intestine is well recognized. It is not uncommon for a surgeon of wide experience to pass through his entire career without encountering a case. The report of every case is therefore of interest.

According to Ewing (11), carcinomata of the small intestine comprise 3 per cent of all intestinal carcinomata. Nothnagel's (32) autopsy reports of the Vienna Pathologic Institute for 23 years (1870–1893) and those of Mueller (31) from Basel for 30 years (1874–1904) show that in 53,152 autopsies, 4,494 cases of cancer were found. Of this number 466 were intestinal and 25 were located in the small intestine—13 in the duodenum and 12 in the ileum. Hedlund (16) collected from the literature 658 cases of intestinal cancer, and Lichtenstein (25) 770, making a total of 1,428, of which 39 were in the duodenum and 38 in the remainder of the small intestine. Brill (5), in 1914, estimated that cancer of the intestine, excluding the stomach, forms 2.5 per cent of all cancers found in hospital autopsies; Jefferson (20) estimates 3.1 per cent. Forgue and Chavin (13) in collecting and tabulating the findings in 88,031 autopsies report cancer as occurring 6,847 times, 8 per cent. Of these 642, 9.2 per cent, were intestinal, the large intestine being affected 613 times, about 9 per cent, and the small intestine in 6 per cent. This is a much larger percentage, however, than is usually recorded. Among Tuttle's (37) 2,432 cases, exclusive of the stomach, in 69 the carcinoma was located in the small intestine, and in 2 in the jejunum. In his report of 2 cases of primary carcinoma of the jejunum, Soper (36) records a series of 43 cases of ileojejunal cancer collected by Schleeps (35) in 1908. To this list Soper adds 12 cases found omitted from Schleeps' report, making a total of 57 cases. In Schleeps' series the growth was in the duodenum in 19 cases, in the ileum in 22 cases, while in 2 cases it was not definitely located. Hintz (19) in 1912 abstracted the histories of 52 cases of carcinoma of the jejunum and ileum.

Judd (22) writing in 1919, states that in the Mayo Clinic, carcinoma has occurred 24 times in the small intestine as compared with 1,822 times in the large intestine and rectum, and 1,689 times in the stomach. In this series the growth was found five times in the duodenum, eleven times in the jejunum, and six times in the ileum. In two cases the lesions were multiple. In an investigation as to lymph-gland involvement in carcinoma of the small intestines, Craig (7) analyzed 36 cases; of these the jejunum contained 46 per cent of the primary growths. Bland-Sutton (4) states that the nearer one approaches to the beginning and the ending of the small gut, the more frequently one finds cancer, and that such a growth in the mid-portion is very rare. This does not correspond with the statement that 46 per cent of carcinomata of the small intestine are found in the jejunum, or with the finding of 11 carcinomata of the jejunum in Judd's series of 24 cases.

Among others who have reported cases of carcinoma of the small intestine during recent years are Johnson (21), who reports 2 cases of carcinoma of the jejunum and 1 of the ileum; Bevan (3), who records 5 cases of cancer of the jejunum; Lichty (26), 6 cases of cancer of the duodenum; McGuire (30), 4 cases; Herman (17) and Portis (33), each 2 cases; Jefferson (20), Deaver (9), Head (15), Baillat (2), Freudenthal (12), Macewen (28), C. B. Davis (8), P. P. Lynch (27), Traylor (38), Vicker (39), Kendall (23), and Primrose (34) one case each.

A review of all the recorded cases shows that primary carcinoma of the duodenum is more common than carcinoma of the jejunum or ileum, and that the jejunum is least frequently the site of malignant growth.

According to Ewing, tumors of the small intestine are of three distinct forms: (1) Part of a local or general intestinal polyposis.

This form is rather rare in the small intestine, being more frequent in the colon. This type probably explains the occurrence of multiple carcinoma, with perhaps several strictures. (2) Multiple or single embryonal, carcinoid tumors, which are usually found in the ileum or jejunum in the form of single or multiple firm, opaque nodules as large as a pea or bean. They lie in the mucosa or submucosa. In structure they form three groups, according to whether they spring from pancreatic island tissue, heterotropic intestinal mucosa, or glands. (3) Localized adenocarcinomata, which rise under various conditions from single intestinal polyps and tend to maintain an adenocarcinomatous structure. The majority of intestinal carcinomata are of this type. When ulceration is delayed, the tumors may reach sufficient size to obstruct the lumen. Metastases are present in one-third of the cases and involve the mesentery, liver, lungs, and peritoneum. One case of multiple growths has been reported in which there were secondary deposits in the lungs and bones. Craig (7) studied a series of 36 cases of carcinoma of the small intestine in order to determine the incidence of glandular involvement. He found such involvement present in 23 cases, 53 per cent. Each case averaged 1.25 glands.

Johnson (21) recognizes four varieties of primary carcinoma: (1) the stenosing form producing a ring stricture of the gut; (2) the polypoid form, in which a rounded mass of growth extends into the lumen; (3) that form in which the growth is attended by extensive ulceration, and (4) colloid carcinoma. Krompecher (24) in his investigation of these intestinal growths found that they bore a marked resemblance to basal cell cancer of the skin. He has written an article entitled "Basal Cell Tumors of the Cylindrical Celled Mucous Membranes, with Special Reference to Carcinoids of the Intestines." He says that these tumors consist of small spheroidal cells; that they are supposed to have their origin in the basal cells which lie between the cylindrical cells and the crypts of Lieberkuhn, and that they are met with in both the small intestine and the appendix. In the intestine they are usually quite small, generally multiple; they resemble small scirrhus cancers, and not being circular do not cause stenosis. This type of growth is rarely malignant. In most cases of cancer of the small intestines, the growth is a cylindrical cell adenocarcinoma. Scirrhous cancer of the small intestine is exceedingly rare. Baillat (2), in 1924, was able to find only 7 cases in the literature.

The average age of patients developing carcinoma of the small intestines has been estimated at 46½ years, although a case has been reported by Duncan (10) occurring in a child of 3½ years. Macewen (28) reports a case of adenocarcinoma in a youth of 20. In this case the onset of the illness was very sudden, with violent pain, persistent vomiting, and great abdominal distention. At laparotomy, a tumor the size of a small walnut projected from the side of the ileum and a small perforation was found at the base of the tumor. The tumor had caused ulceration of the bowel wall and had then protruded through the aperture. In this case a second pedunculated tumor was found inside the bowel about 2 inches lower down. Another case of adenocarcinoma of the small intestine in a girl of 19 is described by C. B. Davis (8). In this case an intussusception was found at operation and 8 inches of the ileum and the large gut to the transverse colon were removed. In spite of the finding of large glands in the mesocolon, this patient was alive and in good health 3 years after operation.

CARCINOMA OF THE DUODENUM

In the duodenum carcinoma is found most frequently in the middle portion or periampullar region. The incidence is next larger in the first portion, and most uncommon in the juxtajejunal portion. About 70 per cent of all cancers of the duodenum are located in the ampulla. Those located above this area are of particular interest because this portion of the duodenum is so commonly the seat of ulcer, and this suggests the question as to the tendency of these ulcers to undergo malignant degeneration. Judd finds little evidence to show that carcinoma of the duodenum ever arises from an ulcer. Jefferson has collected 30 cases from the literature in which it is possible that the malignant change took place in an ulcer. Mayo (29) found one

case in which the growth seemed to be engrafted on a pre-existing ulcer. Shrater, Ewald, Mackenzie, Leballe and Letulle (quoted by Forgue and Chavin, 13) have reported similar cases. It may be said, however, that new-growth following a pre-existing ulcer is exceedingly rare. Cancer in the ampullar region of the duodenum is characterized by painless jaundice and great emaciation. In the infra-ampullary part of the duodenum, carcinoma usually occurs as a primary constricting lesion. Such cases are often diagnosed as pyloric obstruction, though the clinical features are different in that the patient with duodenal obstruction due to cancer usually vomits a large amount of material containing bile and pancreatic secretion. The tumors are usually small and produce a marked degree of obstruction. If they are not attached posteriorly to the vena cava they may sometimes be removed satisfactorily (Judd). Carcinoma of the third part of the duodenum is suggested when marked dilatation of the duodenum is encountered.

CARCINOMA OF THE JEJUNUM AND ILEUM

In these localities carcinoma occurs either as a degenerative polyp or as a ring carcinoma, like that seen in the large intestine. In the degenerative polyp type, there is usually no evidence of the condition until the tumor has been forced down into the lumen of the bowel, producing intussusception and obstruction. Intussusception is commonest in the polypoid form of growth. These tumors in the jejunum rarely become sufficiently large to interfere with the lumen of the intestine. They may, however, be multiple, as in two of Judd's cases. In the ring type of carcinoma the onset of the obstruction is gradual and often the lesion is located with difficulty. The tumor is small and is not palpable in the early stage of the disease, although peristaltic waves may be in evidence. On exploration the proximal loop of intestine will be found greatly dilated and the wall hypertrophied, due to the gradually increased exertion in carrying on its function. Later the growth often becomes large and involves so much of the intestine that it is often mistaken for tuberculosis. Frequently the lumen of the gut is not greatly interfered with by the growth so that it may become very extensive before it is recognized. Comparatively few carcinomata occur at the ileocæcal valve. Judd states that in his cases, nearly all the growths were several inches above the valve, although a number of cases are reported in the literature in which the growth seemed to arise directly in the mucosa at the juncture of the large and small intestine.

A number of cases of multiple tumors of the small intestine have been recorded, as for example that of Bailey (1), in which one growth the size of an orange was situated 18 inches below the ligament of Trietz, while a second tumor, slightly smaller, was found 4 feet lower down in the intestine. When this occurs, the more distal tumor or tumors are probably implantations from the more proximally located primary tumor. Bunting (6), in 1904, described a case of multiple carcinoma of the small intestine in which the patient died of heart disease without any history of intestinal symptoms whatever. Throughout the length of 50 centimeters of the upper ileum were scattered six firm, opaque, white nodules, 3 to 7 centimeters in diameter, and covered by mucous membrane. This author refers to six other recorded cases of a similar nature, in all of which death resulted from other causes.

SYMPTOMS AND DIAGNOSIS

In the cases reported in the literature an early diagnosis was not made. It was only when symptoms of acute obstruction appeared that operation was undertaken and the nature of the tumor was discovered. Many of the reported cases are necropsy findings. The clinical picture depends, of course, upon the type and the stage of growth. In the early stage there may be no subjective symptoms; in the latter stages the symptoms are those of more or less complete intestinal obstruction. The usual symptoms are loss of weight, anæmia, asthenia and vague abdominal discomfort. Later, as obstruction begins, pain increases. It may be colic-like or paroxysmal, especially when there is much tympanites. At times there is constipation which may become progressively severe, with definite stenosis at the tumor site. Again, there may be

no constipation but instead diarrhœa, or diarrhœa and constipation may alternate. Stomach symptoms soon make their appearance, vomiting is frequent, possibly eight or ten times daily, the vomitus being greenish in color, although in a well developed case it may be brownish and have a fæcal odor. The symptoms which are of the greatest diagnostic value are stubborn constipation, with or without alternating diarrhœa, severe attacks of colic-like pain, and vomiting. Objective symptoms are not found early, but with increasing obstruction there is tympanites and visible peristalsis and a tumor may be palpated. The tumor is usually small, firm, movable, and changeable in location.

Although hæmorrhage is uncommon in the early stages of carcinoma of the small intestine, even in the earliest stages some erosion occurs, and occult blood may be found in the stools. Gross blood is rarely present. A search for occult blood is therefore a diagnostic measure of great importance and should never be omitted in a case in which other symptoms are at all suggestive of intestinal carcinoma. Laboratory study of the gastric contents does not give any evidence of the disease. The X-rays are of great help in diagnosis. The finding of a normal stomach and duodenal bulb will rule out cancer of these structures as a cause of the symptoms or the presence of occult blood in the stools. Usually the roentgenogram will show dilatation of the intestine above the site of the obstruction, and it often serves to locate the lesion with a fair degree of accuracy, as it did in the author's case. The duration of symptoms varies from a few days to about 6 months in the majority of cases, although a few have been reported in which there had been symptoms of many years' duration referable to the stomach.

Johnson, who reports one case of cancer of the ileum and two cases in which the growth was in the jejunum, has made a comparison of the symptoms, and points out an interesting difference. In the two cases of jejunal cancer the distention and visible peristalsis were limited to a single coil transversely, in one case above and in the other immediately below the umbilicus. In the case of cancer of the ileum there was considerable general distention and the "ladder" arrangement was very marked, the peristalsis being seen in four or five transverse coils lying partly above and partly below the umbilicus. The diagnosis in this case was probable pyloric obstruction. For 6 months the pain was chiefly in the umbilical region, with occasional vomiting. The attacks usually started shortly after taking food, and vomiting relieved the pain. There was considerable shifting, dullness in the flanks, tenderness above and to the right of the umbilicus, and much splashing and gurgling could be felt over the entire abdomen.

TREATMENT

The treatment of carcinoma of the small intestine, like that of carcinoma in other portions of the gastro-intestinal tract, is surgical. If the tumor is not suitable for removal, a lateral anastomosis may be performed. Although resection of the bowel with all the associated glands is the operation of choice and produces the best postoperative results, yet anastomosis around the lesion results in a high percentage of postoperative longevity (Craig). In the presence of a marked degree of obstruction, surgeons are agreed that immediate resection of the intestine is almost certain to lead to disaster, and that the two-stage operation offers the patient the better chance for survival. The artificial anus should be made above the growth, a procedure attended with much danger to the patient, partly on account of the rapid emaciation likely to occur, and partly because of the damaging effect of the bowel contents on the surrounding skin. The second operation should be carried out with as little delay as possible.

PROGNOSIS

From a review of the after-history of the majority of cases of carcinoma of the small intestine, the outlook for recovery from the disease does not appear promising. Craig found that prognosis was most favorable when the disease is located in the jejunum. In these cases the hospital mortality was least and the percentage of longevity was greatest. There seems to be a high mortality from lesions of the ileum, although a few cases are recorded

in which an uneventful recovery ensued. I. Hieng Liu (18) reports three cases of carcinoma of the small intestine. The first occurred in a man aged 35, in whom an abdominal tumor could be palpated. The patient had suffered from primary anæmia for six months, but never had symptoms of intestinal obstruction. At operation a tumor the size of an orange was found in the ileum, and a large mass of glands of the same size in the mesentery. There was a recurrence later and the patient died. In the second case, a man aged 53, the patient had had chronic intestinal obstruction for several months. The tumor in this case was found in the jejunum. The third patient, aged 68, complained of chronic intestinal obstruction. The roentgenological diagnosis was carcinoma of the colon. At operation a hard mass which proved to be carcinoma was found in the lower portion of the ileum.

AUTHOR'S REPORT

E. S., female; aged 59 years; a housekeeper; referred by Dr. H. M. Bunnell of Waynetown, Indiana; admitted to St. Vincent's Hospital, Indianapolis, February 27, 1925, complaining of vomiting after meals, pain in the epigastrium, intestinal colic, constipation, and loss of weight and strength. The patient's father died at 80 years of old age; her mother died of apoplexy at the age of 68; one sister died in infancy, another of pulmonary tuberculosis, while the cause of death of a third sister was unknown.

The patient had been a healthy child. She had diphtheria at the age of 4½ years, scarlet fever at 5, and then measles and mumps, recovery from each of these diseases being uneventful. Menstruation began at 12 years and a normal menopause occurred at 44 years. There was nothing abnormal in the menstrual history except for a slight dysmenorrhœa. When 15 years of age the patient fell, sustaining an injury to the spine for which she was compelled to wear a brace during a period of 14 years. She was never rugged after this injury. She had an attack of influenza 35 years previously, when she was confined to bed for 7 weeks. Again in 1918 she had an attack of influenza, with three relapses. She had complained of stomach symptoms ever since the spinal injury. These symptoms consisted of indigestion, gas, and distress. She could not eat meat or drink milk without suffering from indigestion.

The history of the present illness was taken by Dr. A. B. Graham during the time she was under his observation. In September, 1924, the patient began to have severe pain in the epigastrium, intestinal colic, and attacks of vomiting. At times she vomited a greenish fluid from 1 to 3 hours after meals. All these symptoms had gradually become intensified, with occasional few days' relief. The attacks of vomiting occurred at intervals of 2 or 3 days. The patient was constipated, but during the past 3 months had passed occasional normal stools. Lavage and enemata had given marked relief, with the result that she had gone 9 days without vomiting. Lavage secured the contents of the small intestine which had been regurgitated into the stomach. The patient's best weight was 127 pounds at the age of 15; in October, 1924, her weight was 105 pounds, and at the time of admission was from 85 to 90 pounds.

Physical examination. The abdomen was flaccid and slightly tender to deep palpation over its entire area. The symptoms were those of incomplete ob struction in the lower small intestine.

Roentgenographic examination. The roentgenologist's report stated that the stomach was of the elongated hook type, with marked ptosis. It was freely movable, and was negative for filling defects. The peristalsis was decreased, but the waves passed completely through the stomach. At the end of 5 hours there was retention of one-half of the stomach contents. The small intestine showed marked distention, apparently due to an obstruction rather high up in the ileum. At the end of 24 hours, the retention remained the same as at 5 hours. This was attributed to reverse peristalsis. From these findings it was concluded that the stomach was negative and that there was an obstruction in the ileum.

Blood count showed red blood corpuscles, 3,560,000; hæmoglobin, 80 per cent; leucocytes, 5,640; polymorphonuclears, 67 per cent; small mononuclears, 26 per cent; large mononuclears, 5 per cent; transitionals, 1 per cent. The blood Wassermann was negative.

Stomach analysis: The result of four examinations showed hydrochloric acid negative each time; the total acidity shown by these examinations was 16, 26, 28, and 30, respectively. The retention was 130 cubic centimeters. The reaction for mucus was plus 4; there was no blood but a great deal of bile. Digestion was fairly good.

Urinalysis: specific gravity 1,010; urine negative for both albumin and sugar; no casts; many pus cells.

The patient's temperature ranged from 98 degrees to 98.4 degrees F.; pulse from 60 to 86; respirations from 18 to 24.

The final pre-operative diagnosis was obstruction of the small intestine, probably in lower ileum.

Immediate surgery was advised as the only method of treatment. Surgery was refused, the patient returned to her home, and the author was not called until complete obstruction occurred. There was moderate distention but the abdomen was not tender. A mass could be palpated in right lower quadrant.

Operation. On opening the abdomen, after the usual preparation, we found enormously distended coils of small intestine protruding from the wound. The tumor mass that had been felt before the abdomen was opened was easily found and exposed. It was situated in the ileum about 12 inches from the

ileocæcal valve. No enlarged glands were found, either by inspection or palpation. A section of bowel about 8 inches in length was resected and side-to-side anastomosis was made. The abdomen was closed without drainage. Recovery uneventful.

Pathological report. Pathological work was done in the laboratory of the Indiana University School of Medicine. The gross section consists of a section of small bowel about 8 inches long, with a triangular portion of the adjacent mesentery. At the center of the loop of intestine there is a mass which is firm on palpation and about the size of a pigeon's egg. On opening the intestine we see a fungating mass almost occluding the lumen of the gut. The surface is ulcerated, exposing a colloidal material.

Microscopic examination. The section is so cut that the longitudinal muscle of the gut is seen in cross section. The mucosa shows marked degeneration and the nuclei of its deeper parts fail to take the stain, probably because of faulty fixation. The mucosa abruptly becomes discontinuous and is replaced by a highly infiltrated and œdematous inflammatory tissue, in which are patches of abnormal columnar epithelium arranged in the form of grotesquely irregular glands. Many of these aberrant cells are distended with mucus, producing signet-ring forms. This neoplastic tissue penetrates the gut wall to the serous surface, interrupting and infiltrating the muscularis. In the deep layers of the wall the tissue elements are widely separated by pale-staining material, presumably mucus. In this situation the epithelium shows but little tendency to form glands. The cells occur in solid masses, occasionally assuming a squamous arrangement.

Diagnosis: colloid carcinoma of the small bowel.

Leichtenstein (25), in 1888, in reviewing a series of 780 intestinal carcinomata, discovered 16 cases of primary carcinoma of the ileum. In 1904, Bunting reported but one case of carcinoma of the ileum in 2,200 autopsies at the Johns Hopkins Hospital, and up to 1911, in over 2,500 autopsies at the Royal Victoria Hospital, Montreal, only 2 cases of this nature were found. In the recent literature the two largest series of cases of carcinoma of the ileum are those of Craig, who in his series of 36 cases of carcinoma of the small intestine found the lesion in the ileum 8 times. In the series of 24 cases reported by Judd, the lesion was found in the ileum 6 times.

According to Bunting, the histological nature of the tumor seems to be constant in all the cases described: (1) There is the occurrence of groups of cells (supported by an abundant stroma in the submucosa) having an appearance very similar to the usual type of basal cell carcinoma. (2) There is continuity of some of the tumor acini with the glands of the mucosa. (3) Discrete foci occur, each one presenting identical features. Bunting's case showed local eosinophilia, but no blood changes. These tumors arise from the mucosal glands, and there is an absence of any obvious irritative origin. The origin is not in the cell rests. The process consists in spontaneous gradual proliferation of the fundi of the small glands in small areas of mucous membrane without any tendency to metastasis until a late period of development. The process is similar to what occurs in appendix tumors. In the case described by Granner and Fraser (14), the ileum showed uniform enlargement of the solitary follicles with little or no congestion. About 1.5 meters above the ileocæcal valve, a small nodule occurred 1 by 1 centimeter and projected into the lumen. Thirty centimeters above this was a smaller nodule of similar nature, and still another nodule was found at about the middle of the ileum. No metastases were found in these cases. In Craig's series of 8 cases, 5 showed no glandular involvement. Resection was performed in 7 of Craig's cases. Four of these patients succumbed in less than a week after operation; one lived 90 days, and one was alive and well 14 years after the removal of the primary growth. Bassler reports an interesting case of carcinoma of the ileum in which the symptoms were of 18 months' duration. The patient had had typhoid fever some years before, and the question is raised whether the carcinoma formed on a cicatrix remaining after the perforation of a typhoid ulcer. In this case the first symptom was vomiting, fæcal in type. The peristalsis was most marked; it could be traced from the ileum up and terminated in involvement of the entire stomach. The tumor was found within 2 feet of the cæcum and was 2 inches in length and 1 inch in diameter. The ileum about 2 feet above the growth was united by lateral anastomosis to the ascending colon. This patient made an uneventful recovery.

In Judd's cases of carcinoma of the ileum, the symptoms were of short duration, being present from 1 to 21 months. In one case there had been indefinite intestinal symptoms for 10 years, and in this instance the lesion

formed on a degenerating polyp of the ileum. In another case there was a history of diarrhœa for 2 years. The principal lesion was a carcinoma of the cæcum, and the tumor in the ileum was not responsible for the symptoms. Recently Alexander Primrose (34) has reported a case of carcinoma of the ileum which is of interest not only because of the rarity of the condition, but because of the advanced age (80 years) of the patient. In spite of the patient's age, the symptoms were so urgent that operation was imperative. A constriction of the ileum was found 8 inches proximal to the ileocæcal junction. There was no glandular involvement. The patient made a good recovery and was in good health 2 years after the operation. The growth in this case was an embryoma. No mitotic figures were present.

In the author's case, as in all others reported in the literature, the pre-operative diagnosis was intestinal obstruction. The patient had suffered from indigestion for many years, but a definite increase in the intensity of the stomach symptoms was noted about 6 months before symptoms of obstruction manifested themselves. In Craig's cases the duration of symptoms ranged from 1¼ to 6 months. In view of the poor prognosis given for carcinoma of the small intestine, the outcome in this case was rather unusual. A point of particular interest is the information supplied by the roentgenological examination, which not only confirmed the diagnosis of intestinal obstruction, but located the lesion definitely before operation.

CONCLUSIONS

1. Carcinoma of the small intestine is a rare condition. It occurs more frequently at the upper and lower ends of the small intestine than in the intervening portion.

2. The symptoms of carcinoma of the small intestine are those of intestinal obstruction. In no reported case has the diagnosis been made before operation.

3. When there are indefinite symptoms that might be suggestive of partial intestinal obstruction, examination of the stools should be made for occult blood.

4. The X-ray gives valuable assistance in the diagnosis of intestinal stenosis and in locating the lesion.

5. The finding of a colloid carcinoma in the author's case is of interest, as this is the rarest type of carcinoma found in the small intestine.

BIBLIOGRAPHY

1. Baily, F. W. Multiple primary carcinomata of the jejunum. J. Missouri State M. Ass., 1912, ix, 53.
2. Baillat. Arch. de l'app. digestif., 1924, xiv, 218.
3. Bevan, A. D. Carcinoma of the jejunum, etc. Surg. Clin., Chicago, 1917, i, 471.
4. Bland-Sutton, Sir J. B. On cancer of the duodenum and small intestine. Lancet, London, 1914, ii, 931.
5. Brill. Am. J. M. Sc., 1914, cliv, 824.
6. Bunting, C. H. Carcinoma of the ileum. Bull. Johns Hopkins Hosp., 1904, xv, 387.
7. Craig, M. McK. Lymph glands in carcinoma of the small intestines, etc. Surg., Gynec. & Obst., 1924, xxxviii, 479.
8. Davis, C. B. Adenocarcinoma in girl of 19, with extensive gland involvement. S. Clin. N. America, 1924, August.
9. Deaver, J. B., and Ravdin. Am. J. M. Sc., 1920, clix, 469.
10. Duncan. Quoted by Traylor.
11. Ewing, J. Neoplastic Diseases. Philadelphia: W. B. Saunders and Company, 1922.
12. Freudenthal, P. Carcinoma of the small intestine. Hospitalstid., 1922, lxv, 785.
13. Forgue and Chavin. Rev. de chir., 1915, xliv, 470.
14. Granner, O. C., and Fraser, J. R. J. Path. and Bact., 1912–13, xvii, 165.
15. Head, G. D. Am. J. M. Sc., 1919, clviii, 182.
16. Hedlund, J. A. Albmann. Svenak., Lakarted, Stockholm, 1916, xiii, 517.
17. Herman, N. B., and von Glahn, C. W. Am. J. M. Sc., 1921, clxi, 111.
18. I. Hieng Liu. Arch. Surg., 1925, ii, 602.
19. Hintz, R. Arch. f. klin. Chir., 1912, p. 305.
20. Jefferson. Brit. J. Surg., 1916, October.
21. Johnson, R. Brit. J. Surg., 1922, ix, 422.
22. Judd, E. S. J.-Lancet, 1919, xxxix, 159.
23. Kendall, G. M. Brit. J. Surg., 1925, xii, 617.
24. Krompecher. Ziegler's Beitr. z. path. Anat., 1919, xlv, 79.
25. Lichtenstein. Ziemssen's Handbuch, 1888, vii, 523.
26. Lichty, J. A. Peptic ulcer and carcinoma in the duodenum. New York State J. M., 1918, xviii, 433.
27. Lynch, P. P. Cancer of the jejunum. J. Path. & Bact., 1925, xxviii, 394.
28. Macewen, J. A. C. Adenocarcinoma of the small intestine in youth of 20. Lancet, 1922, i, 693.
29. Mayo. J. Am. M. Ass., 1901, October 19.
30. McGuire, E. R. Arch. de mal d'appar. dig., 1920, x, 419.
31. Mueller, Fritz. Inaugural dissertation, Basel, 1905.
32. Nothnagel. Die Erkrank. des Darms. Vienna, 1898.
33. Portis, M. M., and Portis, S. A. Carcinoma of the small bowel. Am. J. Roentgenol., 1923, x, 419.
34. Primrose, Alexander. Primary carcinoma of the small intestine. Ann. Surg., 1925, lxxxii, 429.
35. Schleeps, W. Beitr. z. klin. Chir., 1908, lviii, 3.
36. Soper. Boston M. & S. J., 1909, July 22.
37. Tuttle. Quoted by Baily, F. W.
38. Traylor, G. A. J. M. Ass. Georgia, 1924, xiii, 436.
39. Vicker, D. M. Ann. Surg., 1924, lxxix, 239.

ANEURISM OF THE SUBCLAVIAN ARTERY: LIGATION OF FIRST DIVISION AND INTRASACCULAR SUTURE[1]

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ANEURISM of the subclavian artery presents special surgical problems in its treatment. With few exceptions, this condition proves fatal when it is left untreated, as rupture takes place either externally or into the pleura, trachea, or bronchus. As the aneurismal sac enlarges, it encroaches upon important structures, pressure symptoms manifest themselves, considerable pain is present either at the site of the tumor or referred to more distant parts of the limb, neck, or shoulder, and the resulting necrosis may involve not only the soft structure, but also the clavicle. There is an alternation in the circulation of the affected limb which usually becomes atrophied, and the function and usefulness of the extremity is impaired.

In a review of the subject Matas refers to Souchon's statistics in which in 115 cases studied, 81 were of idiopathic and 31 of traumatic origin. Aneurisms of the first and second divisions are less frequent than those of the third division. Of 551 cases of aneurisms in general, about 4 per cent were of the subclavian type. Non-operative measures have as a rule failed to effect a cure. Of a number of different operative procedures, that of ligation and treatment of the aneurismal sac has given the best results.

The older surgeons considered ligation of the subclavian artery, especially on the left side, an impracticable procedure. Sherrill, who studied the matter of ligation of the subclavian artery in 1910, found that the ligation of the artery, anteriorly, in its first division on the left side had been successfully accomplished by Halstead, Schuempert, and Juengst, and quotes Halstead as stating that the right subclavian, in its first division had been ligated twelve or more times, and that each case resulted fatally.

According to J. H. Armsby, the first division of the subclavian artery has been ligated thirteen times with one recovery. From a review of the cases that have been reported it becomes evident that ligation of the first portion of the left subclavian for aneurism is a serious and difficult procedure, although the results in recent years when modern aseptic methods of operating have been employed have shown considerable improvement.

In aneurisms of the subclavian artery that are large and encroach upon important structures of the neck, the method of surgical attack offers a difficult problem, and in those cases in which ligation of the first part is to be done, the surgeon must decide whether this shall be attempted anteriorly or posteriorly through the chest wall. A method of posterior attack was described in 1910 by Sherrill who performed the operation by making an incision about 4 inches long along the posterior margin of the scapula, joining this by an incision directed inward from the inferior extremity to the spinous process and another similar incision placed at the upper part of the first incision. Within this area the soft tissues were dissected from the ribs, and the second, third, and fourth ribs were removed for a distance of about 3 inches. By liberating the pleura and pushing it gently downward and outward, the subclavian artery was made accessible and ligation was made possible. A somewhat similar operation for ligating the first part of the left subclavian from behind has been more recently described by A. K. Henry. In approaching the subclavian artery for ligating the first portion from the front, several operators have found it necessary to resect the clavicle. However, a simpler procedure, based on anatomical landmarks is perfectly feasible.

For concrete consideration of the subject of aneurism of the left subclavian artery, it may serve our purpose to narrate briefly the following case which came to me for operation:

The patient, W. Y., a colored man, 39 years of age, referred to me by Dr. L. Grosse, stated that in 1913 while living in Russellville, Kentucky, he was shot through the left shoulder, the bullet entering the upper and mid-portion of the clavicle, and after taking a direction inward and downward through the neck lodged under the skin to the right of the spine and on a level with the first dorsal vertebra. The bullet was promptly and easily removed by the doctor who first saw him. While the wounds healed readily, he could not, in the beginning, use the hand of the affected side, though later on the usefulness of the left hand and arm returned. Shortly after the injury a small pulsating tumor, which was scarcely visible, developed above and adjacent to the clavicle at the middle portion. In the same year he went to a hospital in St. Louis where an operation was to be performed, but on being informed of the danger of the operation he decided not to be operated upon. For 10 years the tumor remained about the same size and he was able to continue with his work as a furniture mover until one day while carrying a heavy load on his shoulder he had a sudden pain in the region of the tumor. The tumor then grew steadily larger and began to

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encroach on the side of the neck. He lost the use of his arm, and suffered pain not only in the shoulder but also in the hand and especially in the thumb and first finger. It was on account of the pain and gradual enlargement of the tumor that the patient finally sought surgical relief.

In eliciting the history of the case, nothing of interest was brought out that had a special bearing on the patient's present condition. He was usually healthy as a child and in later years had never been sick. He denied having had any venereal diseases. He used to drink beer and whiskey daily, but seldom got drunk. He was of normal weight and stature. His appetite was good and he had slept well except for the pain in the shoulder and arm. The functions of the bladder and bowels were good. The heart and lungs were normal. His right arm had been broken, but complete usefulness had been regained. He had never been operated upon.

Relative to his present condition, the following observations were recorded. In the supraclavicular region behind the middle third of the clavicle, there was an expansile and pulsating tumor, dome-like in appearance, which measured 3.5 inches across and 4.5 inches in its longest diameter (illustration). The tumor was in contact with the clavicle and also extended inward as far as the neck. The usual characteristics of an aneurism were elicited. A roentgenogram of the left shoulder girdle showed a large subclavian aneurism with marked calcification of the subclavian artery. The blood pressure was 150-108, and was the same for both the right and left arm. The pulse rate was 92 per minute. Comparative measurements showed definitely atrophy of the left arm. Sensation was present everywhere over the skin of the left arm, forearm, and hand. The movements of the left arm and hand were slightly restricted, and compared with the right, the skin was of a paler color. Pressure symptoms of the tumor were present and there was pain in the region of the mass and the affected extremity. It was on account of the pain that the patient sought surgical relief.

Operation. The operation was performed under general ether anæsthesia, preceded by the administration of morphine sulphate, ¼ grain and atropine sulphate, 1/150 grain. A skin incision about 3 inches long was made along the outer and lower border of the sternomastoid muscle and from the lower end another incision was made in an outward direction parallel to the clavicle and over the tumor. A triangular flap of skin with the platysma was dissected free after ligation of the external jugular, to expose the underlying structures.

The outer border of the sternomastoid was made free by dissection along the fascial planes, and by inward retraction of the muscle the jugular vein, the carotid artery and the pneumogastric nerve were exposed. The digastric muscle which crosses these structures was severed. In this location it was found that the aneurismal sac extended toward the carotid and by contact seemed to be a part of this artery. The internal jugular vein was traced to the subclavian vein and the thoracic duct was defined. In order to expose the scalenus anticus, it was necessary to free by dissection a number of glands and a part of the sac of the aneurism. The phrenic nerve was seen as it lay flat upon this muscle. With the anterior border of the scalenus anticus as a guide, by finger dissection the entire border was exposed as far as the first rib. Behind the muscle was felt the pulsation of the aneurism but the normal subclavian artery was not defined. The finger passing along the insertion of the scalenus anticus, the dissection was continued beneath the first rib and along the left side of the bodies of the vertebræ. The arching portion of the subclavian artery lay deep, as far as the tip of the index finger could reach, but was readily then laid bare by deep retraction and blunt dissection. The pleura was not so readily defined, and the resembling fascial structure might therefore easily be injured.

Front and side views of patient.

With the use of deep narrow retractors, the subclavian artery was seen lying deep at the bottom of the space. The sheath of the artery was separated and with an aneurism needle a double strand of No. 2 chromic catgut was placed at the first portion of the subclavian artery and the vessel was ligated. Pulsation in the aneurismal sac ceased at once. There was no accident or complication in performing the ligation. On account of the depth and limited space, an aneurism needle with the arm making an obtuse angle with the shaft is to be preferred in passing the ligature. Ligation of the artery was so readily performed that obliteration of the aneurismal sac was next attempted. The structures overlying the most prominent part of the sac were made free, and as had been done in numerous other instances, the sac was freely incised and 50 to 60 cubic centimeters of soft light brown and friable clot was removed. The outer covering of the sac was fibrous in character, while the inner coating peeled off easily, was soft, thin, smooth, bluish, and on the inner side resembled intima. In spite of the ligation, hæmorrhage from within the sac was quite profuse and came from the region of the internal mammary artery, the vertebral and thyroid axis. The sac had several chambers or pockets; one under and behind the mid-portion of the clavicle which formed the wall of this portion of the sac. Another pocket was in the region of the internal mammary artery, and a third projection extended behind the scalenus anticus muscle. The inner part of the wall showed calcareous deposits behind the intima. There was no bleeding from the distal part of the sac. The bleeding vessels leading to the sac could not be clamped off and hæmorrhage had to be controlled by compression. With difficulty, suture was placed and bleeding from the internal mammary artery was controlled by ligation. The brachial plexus could not be defined and the area was involved in dense cicatricial tissue. Sutures were placed to control hæmorrhage from the vertebral artery and thyroid axis, but owing to the pocket formation, ligation *en masse* had here to be employed, as we realized the possibility of encroaching on the nerves of the brachial plexus. It was a great relief when all hæmorrhage was controlled. The globular portion of the sac was obliterated by imbrication of the margins as recommended by Matas, and the resulting mass was about 3 centimeters in diameter. The cut skin margins were approximated with silkworm-gut sutures. Though the operation was long and tedious, the patient stood the operation fairly well and reacted shortly

after being placed in bed. Though the pulse was absent, there seemed to be evidence of a sluggish circulation and the entire extremity was placed in cotton and kept warm.

The postoperative course as to the patient's general condition was uneventful. There was impairment of the extensor muscles of the forearm resulting in wrist drop, though sensation everywhere was complete. On the third and sixth day a quantity of sero-sanguinous fluid was liberated from the wound in the neck. Good wound healing without infection ultimately resulted.

The patient had not been seen for nearly 2 years. He had not used the arm much and there was considerable muscular atrophy. The wrist drop had improved slightly. With massage and properly directed exercise a fairly satisfactory result may yet be obtained. The aneurism has remained completely cured. The radial pulse cannot be felt and the blood pressure on the affected side could not be recorded.

In determining upon a method of surgical attack in aneurisms of the subclavian artery several methods present themselves for consideration. Ligations may be performed as conservative measures. Ligating the artery distal to the sac has not given good results. Ligations proximal to the sac have in a few instances brought about a cure, but mostly the simple ligations of the subclavian artery alone have resulted in recurrences. The gradual obliteration by the use of Halsted's aluminum bands is of service especially if there is any doubt as to the circulation in the extremity.

A study of the efficiency of the collateral circulation is always important and tests should be made to determine this. The hyperæmia reaction or color test, the preliminary occlusion of the main vessel by the use of removable bands, oscillometric manometry and clinical observation tests in spite of the absence of the pulse are of value, but may be difficult of demonstration in subclavian aneurism. When an aneurism develops gradually there is a tendency for the collateral circulation to adjust itself just as in the gradual obliteration by the use of bands.

It may be remarked that in pathological aneurisms of the subclavian artery, gangrene of the extremity rarely occurs and this may be explained by the efficiency of the collateral circulation about the shoulder girdle. If there seems to be any doubt as to the circulation and if time and shock are factors, a two stage operation may be resorted to. We must consider the surgical risk as to the life of the patient and also the risk as to the affected limb. The age and resistance of the patient, the size and location of the tumor, and its relation to important structures, the efficiency of the collateral circulation and the possibility of improvement by compression of the main vessel, massage and therapeutic measures, are all important factors for consideration.

The radical procedures resolve themselves into aneurismotomy, aneurismectomy and endo-aneurismorrhaphy. Some operators have obtained good results by complete excision of the aneurism. The simpler endo-aneurismorrhaphy I believe is to be preferred since this operation is more conservative. The restorative and reconstructive operations are of little value, and therefore the obliterative type of operation is to be preferred. When the aneurismal sac is pouched and ramifying as in my case, intrasaccular suture is very difficult and if possible the tributary vessels should be made free so that ligation may be performed if required. It seems easier and best therefore to expose these vessels before opening the sac since otherwise the dissection may be impossible. The case here presented illustrates the necessity of having all of the vessels associated with the sac under control. If there is any doubt as to the collateral circulation, the occlusion of the main artery by the application of the aluminum band or ligature should first be tried. Whether a one or two stage operation is to be performed depends upon the various factors that are associated with the condition. The simpler the procedure the more ideal is the operation in this type of cases and one can safely concur with Matas that endo-aneurismorrhaphy is the operation of choice.

REFERENCES

1. Caldwell, C. E. Traumatic aneurism of the axillary artery; ligation of the subclavian; recovery. Tr. South. Surg. Ass., 1916, xxix, 86.
2. Halsted, W. S. Striking elevation of temperature of hand and forearm following excision of subclavian aneurism and ligations of left subclavian and axillary arteries. Bull. Johns Hopkins Hosp., 1910, July 31, No. 353.
3. Idem. On the use of aluminum bands. J. Exper. Med., 1909, March 1.
4. Idem. Bull. Johns Hopkins Hosp., 1892, iii, 93.
5. Haubold, H. A. Ligation of subclavian artery at first portion for aneurism. Med. Rec., 1916, March 25.
6. Henry, Arnold K. A method of ligaturing the first stage of the left subclavian artery from behind. Brit. J. Surg., 1923, x, 367.
7. Juengst. Beitr. z. klin. Chir., Tuebingen, 1902, xxxiv, 307.
8. Lagoutte, M., and Lapointe, A. Aneurism of the subclavian and axillary arteries; extirpation; cure. Bull. Soc. de chir., Par., 1921, xlvii, 1243.
9. Matas, R. Keen's Surgery v, 327; vii, 772. Endo-aneurismorrhaphy. Surg., Gynec. & Obst., 1925, xli, 701.
10. Noon, Charles. An arteriovenous aneurism treated by ligation of the left subclavian artery. Brit. M. J., 1922, May 6, p. 714.
11. Parham, F. W. Ligation of the subclavian artery. Tr. South. Surg. Ass., 1905, p. 292.
12. Sherrill, J. G. Report of a case of aneurism with a new method of ligature of the left subclavian. Tr. South Surg. Ass., 1910, xxiii, 190.

HERNIA OF THE SUPERIOR EPIGASTRIC ARTERY

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THE case of hernia being reported, although of minor significance clinically, presents such an interesting group of features relating to causation and pathology as to render its detailed consideration both profitable and justifiable.

A robust young male laborer was working on a scaffolding, plastering a ceiling above his head, when he suddenly felt an acute pain across his left lower chest and soon thereafter observed a small lump just beneath the costal margin on the left side. Ten days later when he presented himself for treatment, the tumor had not varied in size but the local pain had become so severe as to induce him to seek medical advice.

Examination disclosed an unusually robust young male who appeared to be in excellent general physical condition. Just below the costal margin about 4 inches to the left of the midline, a hickory nut sized tumor could be seen pulsating beneath the skin. To palpation it was firm, tender, apparently just beneath the skin and its pulsation was definitely expansile.

Operation was advised under diagnosis of traumatic aneurism and, under local anæsthesia, the skin was incised exposing the tumor just beneath it. The mass was then revealed as a tortuous loop of pulsating artery resting upon the ventral surface of the anterior rectus sheath. The pedicle of the tumor was formed by the afferent and efferent limbs of the artery which penetrated a perfectly circular, smooth margined fenestrum in the anterior rectus sheath. Followed through the muscle, these afferent and efferent branches of the pedicle were seen to be continuous upward and downward respectively with the superior epigastric artery in its normal position between the muscle and its posterior sheath. Operation was concluded by excision of the redundant portion of the vessel forming the tumor, ligature of the cut ends, and closure of the rectus sheath.

As far as can be determined, the literature contains no similar type of case, and there is no precedent for classification of this condition as a hernia of the artery. However, definition of the term hernia and its application to conditions here existing appear to make such classification permissible.

Hernia is defined as the protrusion of an organ or part of an organ or other structure through the wall of the cavity normally containing it, and therefore involves the conception of the organ removed from its normal environment but at the same time maintaining by direct continuity of its own tissue some connection with that environment. Ectopia, on the other hand, while it carries the displacement concept, eliminates that of protrusion or continuity with its original locality. It is, therefore, evident that the position and relations of the artery and tumor in this case fulfill those conditions demanded of a hernia within the full meaning of the term, and it is therefore so designated.

ANATOMY

The internal mammary artery runs downward from its origin upon the pleura and the transversus thoracis muscle maintaining a position approximately parallel to the lateral sternal margin and behind the first to the seventh costal cartilages. In the region of the sixth intercostal space, it divides into two main terminal branches, the musculophrenic and the superior epigastric.

The musculophrenic extends downward and laterally over the origin of the pars costalis of the diaphragm, gives off rami intercostales for the seventh to tenth intercostal spaces and terminates as a group of end vessels supplying the diaphragm and abdominal muscles.

The superior epigastric artery passes at once between the processus xiphoideus and the seventh costal cartilage and, according to most textbooks of anatomy, runs downward on the posterior rectus sheath in relation to the posterior surface of the muscle to inosculate with the deep or inferior epigastric artery below. The deep epigastric artery is usually regarded as the main source of blood supply to the muscle and in this capacity is commonly represented as of greater calibre for the conveyance of the larger blood volume while the musculophrenic and the superior epigastric are supposed to bear a rather subsidiary function in this respect.

There are, however, certain variants from this

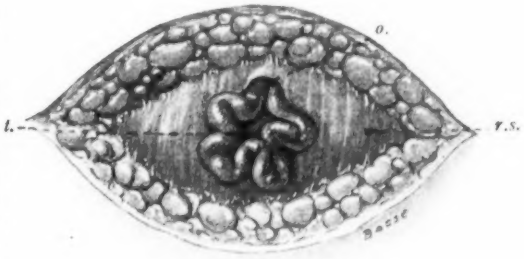

Fig. 1. *o.*, Margin of orifice; *r.s.*, Anterior rectus sheath; *t.*, Tumor.

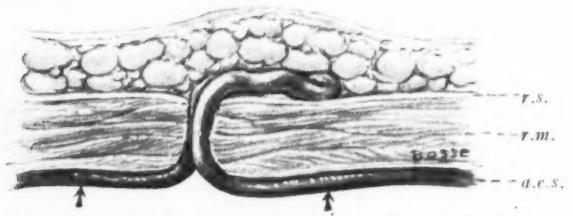

Fig. 2. *r.s.*, Anterior rectus sheath; *r.m.*, Rectus muscle; *a.e.s.*, Superior epigastric artery.

picture which though insignificant anatomically, do appear to have an etiological relation to the conditions found in this case.

From a study of a number of dissections of the region, it becomes apparent that while the inferior epigastric artery is usually the main artery of supply for the rectus muscle and while it develops a disproportionate calibre and blood volume at the expense of its fellow, the superior epigastric which dwindles to insignificance, these relations are not infrequently reversed. In short, there is a definite reciprocal relation existing between these two arteries of supply for in a certain number of cases the superior artery assumes the leading rôle, takes on a large calibre, becomes tortuous and carries the main supply to the muscle.

Under these latter circumstances, a further departure from the conventional picture may be noted when the enlarged superior artery instead of confining itself to the space between the posterior sheath and the muscle, begins to insinuate itself between the fibers of the muscle and eventually approaches its anterior face. This may be conceived as an expression of the failure of the enlarged vessel to accommodate itself to its confined space and, unable to impress the dense fascia posteriorly, it seeks the lines of least resistance and attacks the less formidable muscle. The failure of the inferior artery to behave in a similar manner under like circumstances may be ascribed to the variation in the posterior relations of the two vessels; the superior resting upon the dense rectus sheath above while the inferior trunk during a portion of its course resting upon the comparatively unimportant transversalis fascia.

In seeking to establish the mechanism operating in the causation of this curious condition, certain possibilities suggest themselves. One may recall that the patient, at the time of the onset of symptoms, was working in a strained position applying plaster to the ceiling above his head. It is assumed that his head was thrown back the better to see the details of his work above and, to compensate for the consequent shift of the center of gravity of the body, the knees were held slightly flexed and the body balanced on the toes. In this posture the body assumes the form of an arc or segment of a large circle, its ventral aspect becoming the convex and its dorsal aspect the concave surface of the arc. Simple principles may now be applied to suggest the subsequent course of events. In this instance, the artery, judged from its size and volume, appears to have been the main source of supply to the muscle. The patient, during the course of his type of occupation doubtless frequently assumed the posture described as a result of which the enlarged superior artery, supported on these occasions an increased blood pressure induced by muscular effort and strain. In response to the centrifugal force acting upon it, outward and away from the center of the circle of which the body is an arc, the pulsating artery, under increased pressure, migrates along the lines of least resistance, i. e., through the less resistant muscle, and soon comes to lie beneath the anterior sheath of the rectus. Here again an increased resistance is encountered but the same forces operating, the vessel gradually erodes its way through the anterior sheath of fascia and the last obstacle removed suddenly bursts forth on the ventral surface of the sheath accompanied by the sensation of pain and tumor formation.

The erosive power of arterial vessels is well known in association with the action of aneurism upon confining bony structures, and in this case the smooth, punched out character in the fascial fenestrum is suggestive of the slowly progressive nature of the process.

Hernia of the superior epigastric artery as illustrated in this case must be ascribed to such anatomical factors as large, tortuous artery, dense posterior wall and vulnerable anterior muscular wall together with certain physical and mechanical forces which are induced by posture and transient blood pressure elevation incident to physical strain.

CLINICAL SURGERY

FROM THE MAYO CLINIC

SUPRAPUBIC PROSTATECTOMY FOR BENIGN PROSTATIC HYPERTROPHY

A Consideration of Pre-operative and Postoperative Management

By VERNE C. HUNT, M.D., F.A.C.S., Rochester, Minnesota

SINCE about 1890 much has been contributed with regard to the surgical treatment of the prostate gland, numerous methods having been advocated for its surgical removal, and in recent years, as the result of investigation of the effect of urinary obstruction, methods of pre-operative preparation have been elaborated. Surgery of the prostate has thus been placed on a par with general surgery.

The phenolsulphonephthalein test of Rowntree and Geraghty and the estimation of the urea content of the blood have proved invaluable aids in the determination of renal efficiency, as well as reliable guides in deciding the time at which operation may be undertaken with relative safety. They serve also as a means of relative prognosis.

Death following prostatectomy has been due to the following causes in order of frequency: (1) co-existing or pre-existing cardiovascular-renal and pulmonary disease; (2) surgical accidents (hæmorrhage), and (3) postoperative complications. In recent years effort has been directed toward providing factors of safety in cases of surgical prostatic obstruction, which tend to eliminate causes of death. As a result the mortality rate is less than 3 per cent.

TREATMENT PRELIMINARY TO OPERATION

Two types of cases present the greatest hazards in prostatectomy: (1) that in which prolonged urinary retention has resulted in marked renal insufficiency, and acute uræmia and death are readily precipitated by immediate prostatectomy, and (2) that in which the urinary tract is aseptic and there is retention of but a few ounces of urine as the result of prostatic obstruction, with little impairment of renal function and general sepsis likely to be precipitated by immediate prostatectomy.

Experience has taught that the first type of patient may recover from the actual or potential uræmia, that renal efficiency may be restored or approach normal, and that the cardiovascular-renal reserve may be increased by a period of careful and adequate pre-operative treatment. The second type of patient may likewise be provided with immunity to infection by the same means.

Recent investigation of the relationship of preliminary treatment to mortality rate following prostatectomy has definitely established the necessity of preliminary treatment in all cases. The important factor in preliminary treatment is drainage of the bladder. Bugbee and others have directed attention to the dangers attendant on sudden emptying of an acutely or chronically distended bladder; these dangers are lessened by the method of gradual decompression, as described by Van Zwaluwenburg, which is applicable to all cases. In the small percentage of cases in which urethral catheterization cannot be carried out, the method can be applied following suprapubic cystostomy. The benefits of preliminary treatment are best attained by continuous drainage by urethral or suprapubic catheter rather than by intermittent catheterization. During the period of drainage the bladder may be irrigated to combat co-existing cystitis. Drainage allows recovery of renal function and stabilization of the cardiovascular-renal reserve. The length of time that preliminary treatment is necessary depends on the general condition of the patient; such treatment should be continued until the tests of renal function have become stabilized within normal limits. Only under unusual circumstances should prostatectomy be contemplated when the phenolsulphonephthalein return is less than 20 per cent or the urea content of the blood more than 50 milli-

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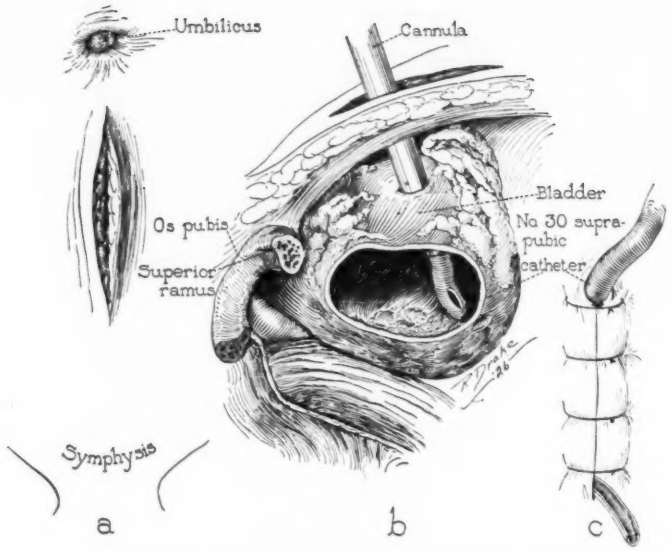

Fig. 1. Cystostomy preliminary to prostatectomy (two-stage operation). *a*, Incision in the upper half of the median line between the umbilicus and symphysis allows downward extension of the incision for the subsequent prostatectomy with little danger of opening the peritoneum; *b*, the trocar has been thrust into the bladder for introduction of the catheter high in the dome after deflection of the peritoneum and preperitoneal fat; *c*, the catheter has been brought out at the upper angle of the incision, thus facilitating extension of the incision downward rather than upward for the subsequent prostatectomy.

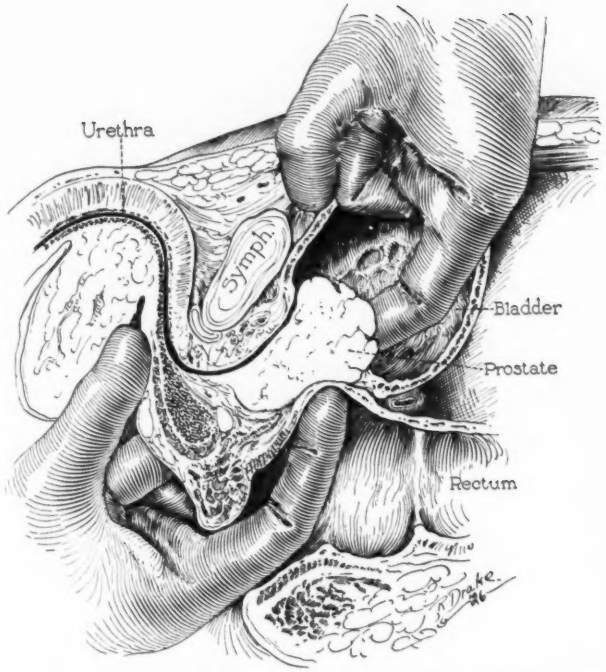

Fig. 2. Bimanual prostatectomy following previous cystostomy. The index finger of the right hand in the anus elevates the gland for digital enucleation with the index finger of the left hand. This is necessary only in the two-stage operation, and facilitates the procedure in lieu of exposure.

grams for each 100 cubic centimeters. In many instances a period of from 10 days to 3 weeks of preliminary treatment assures the relative safety of prostatectomy; however, if renal insufficiency is marked and the patient is in poor general condition, it is necessary to drain the bladder for months before prostatectomy may be undertaken with any degree of safety. Experience has led to the adoption of the minimum of 10 days even in the most favorable cases.

Usually suprapubic prostatectomy is performed in one stage. However, associated lesions of the bladder such as vesical calculi (12 per cent), diverticula (5 to 7 per cent), severe cystitis and marked renal insufficiency requiring prolonged drainage, and senility forbid the uniform adoption of the one-stage operation. Nevertheless, in carefully selected cases drainage of the bladder may be adequately carried out by urethral catheter, thus facilitating in 75 per cent of the cases the one-stage visible operation which permits the application of the general principles of surgery, that is, exposure, accuracy of conduct, and complete hæmostasis.

The effect of drainage of the bladder is enhanced in the presence of co-existing vesical lesions if vesical calculi are removed at preliminary cystostomy and diverticula excised extravesically or transvesically after the method of the late Dr. Geraghty. If in the absence of calculi or diverticula, cystostomy must be performed as a means of drainage preliminary to prostatectomy on account of an impassable urethra, the necessity of prolonged drainage, senility, and so forth, it is best accomplished under local anæsthesia in the most simple manner, through a small low median incision, the peritoneum being retracted and the dome of the bladder exposed before a trocar is thrust in for the introduction of the catheter (Fig. 1).

The occasional low reflection of the peritoneum anterior to the bladder, even when the bladder is greatly distended, presents a hazard to the trocar method, except when the instrument is introduced after the wall of the bladder has been exposed. Preliminary cystostomy for drainage only and not for the removal of calculi and diverticula is most readily accomplished by distention of the bladder with water or an irrigating solution. It is important in the performance of preliminary cystostomy that the trocar be introduced high into the bladder and the catheter brought out at the upper angle of the wound rather than at the lower, or just above the pubes. (Fig. 1, *b* and *c*). This allows enlargement of the incision downward at subsequent prostatectomy and obviates

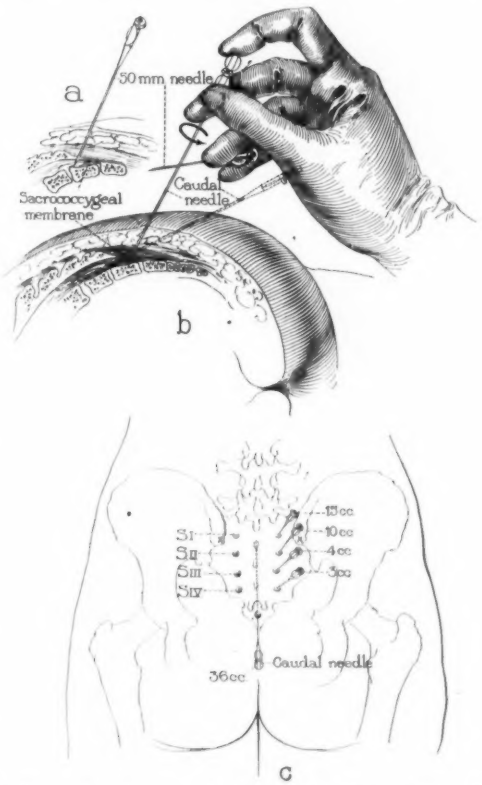

Fig. 3. Sacral nerve block. The injection consists of 100 cubic centimeters of 1 per cent procain solution at body temperature with 6 minims of 1:1000 epinephrin solution (1 cubic centimeter ampule, 1:2600). Patient in the prone position, pillow beneath pelvis. Anæsthesia induced in 15 minutes after injection and lasts for an hour or more. *a*, A 50 millimeter needle is inserted through a wheal and the sacrococcygeal membrane into the tip of caudal canal and 5 cubic centimeters of solution injected to make painless the insertion of the caudal needle; *b*, the 50 millimeter needle is withdrawn and the caudal needle inserted in its stead and advanced into the caudal canal, after being rotated so that the bevel rests on bone; *c*, dorsal view of sacrum with caudal needle in position as well as those in S. I, II, III and IV (that is, the first, second, third, and fourth sacral foramina). A total of 36 cubic centimeters of solution is placed in the caudal canal in the average case. The average amount of solution for each foramen on each side is shown. The sacral nerves are thus blocked; the patient is then turned on his back and the abdominal-wall block is done. (After Dr. John S. Lundy, Section on Anæsthesia, Mayo Clinic.)

the accidental opening and contamination of the peritoneum which is difficult to avoid if the incision must be enlarged upward. Two-stage suprapubic prostatectomy possesses the dis-

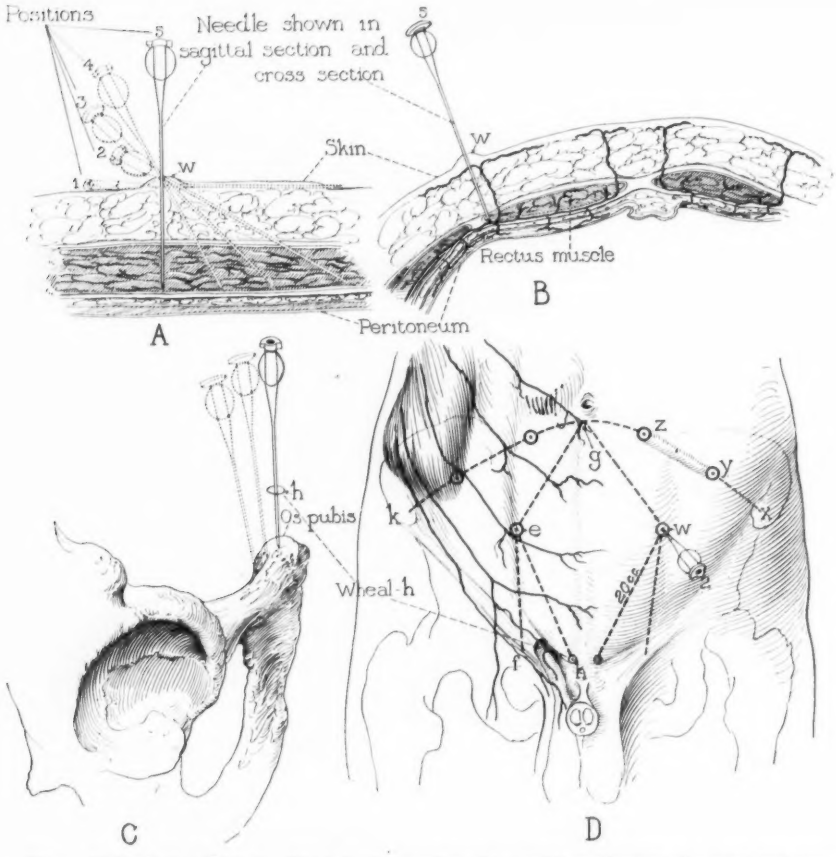

Fig. 4. Abdominal wall block. The injection consists of 100 cubic centimeters of 0.5 per cent procain solution at body temperature with 6 minims of 1:1000 epinephrin (1 cubic centimeter ampule, 1:2000). Anæsthesia is induced in 10 minutes and lasts for 1 hour. The three zones of injection are shown in *D*. In order of frequency of use they are: *e* to *f* and *e* to *g* (no hernia present); *e* to *h* and *e* to *g* (reducible hernia present); *k* to *g* (irreducible hernia present). All are bilateral. The blocks *e* to *f*, *e* to *g*, and *e* to *h* are done from wheal *w*, as shown in *A*, *B* and *D*. The space of Retzius is injected through wheal *h* (*C* and *D*), 10 cubic centimeters on each side. Wheal *w* is shown in sagittal section in *A*, in cross section in *B*, and from in front in *D*; it is placed in the skin at the border of the rectus muscle midway between the umbilicus and pubes. In *D* the appearance of the skin is shown after a solution has been injected from *y* to *z* through the needle in *A* in first position.

In *B* and *D*, the nerves to be blocked are shown in heavy black lines. In *A* the needle is shown in five positions in each of which 2 cubic centimeters of solution is used. Thus a 10 cubic centimeter syringe contains enough solution to block a brick-shaped area, a lateral view of which is shown in *A*. Such blocks, like bricks under various arrangements, result in the various types of abdominal-wall block shown. In *D*, the lines *ef*, *eg* and *eh* each traverses the ventral face of a brick-shaped block of anæsthetized tissue. In the average case two injections of 10 cubic centimeters each are made into each brick; the second reinforces the first one. (After Dr. John S. Lundy, Section on Anæsthesia, Mayo Clinic.)

advantage of inadequate exposure for the second stage. McGowan overcomes this to some extent by a transverse incision with the longitudinal one which he calls the aeroplane incision.

While visible conduct of the operation of prostatectomy is desirable and insures greater accuracy, the two-stage operation necessary in about 25 per cent of cases, does not readily allow

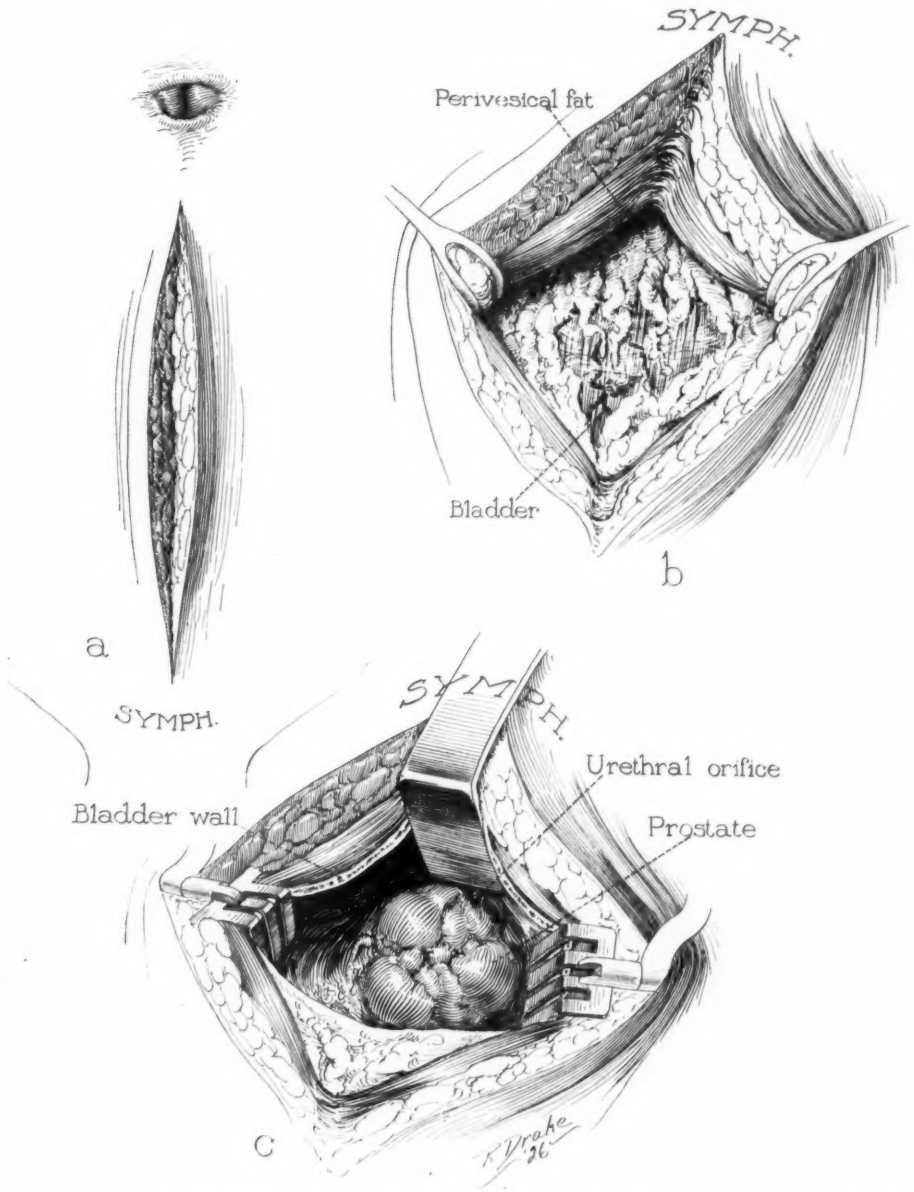

Fig. 5. One-stage suprapubic prostatectomy: *a*, Incision extending from just above the symphysis to within four-fifths of the distance to the umbilicus provides adequate exposure of the operative field; *b*, distention of the bladder with air or solution is unnecessary for its identification; the retraction upward of the peritoneum and preperitoneal fat exposes the collapsed bladder, readily recognized by its longitudinal muscle fibers; *c*, insertion of the bladder retractor allows inspection of the interior of the bladder and enables one to see the entire procedure of removing the gland.

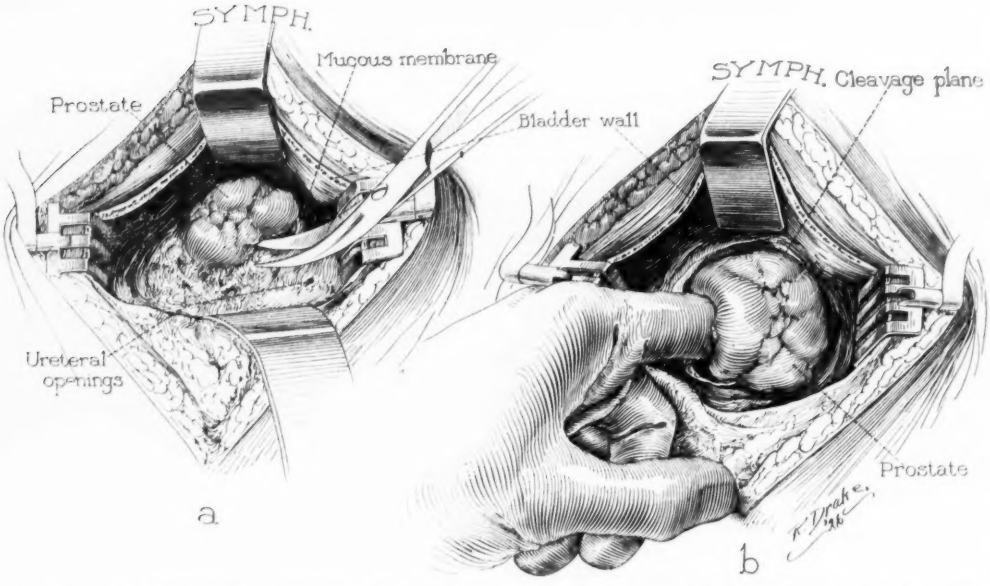

Fig. 6. One-stage suprapubic prostatectomy: *a*, The mucous membrane around the internal urethral orifice or that overlying the intravesical portion of the gland is incised with scissors in order to avoid irregular laceration of the mucous membrane in the subsequent enucleation; *b*, the cleavage plane in adenomatous hypertrophy of the prostate is established in the anterolateral wall of the prostatic urethra, and is carried about the entire circumference of the gland within the capsule.

the exposure of the one-stage operation by virtue of the rigidity of the tissues and the presence of a urinary sinus, and it is usually not advisable to attempt obtaining it, as the chances of opening the peritoneum would be increased. Harm may not result from the accidental opening of the peritoneum during the course of two-stage prostatectomy; however, such accidents, if they do result in urinary contamination of the peritoneum, add a distinct hazard to the procedure. Peritonitis and death following such an accident are not unknown. To avoid the accident after preliminary cystostomy it is usually advisable to sacrifice the advantage of exposure and to extirpate the gland by more or less blind enucleation. In most instances this is accomplished bimanually, the index finger of the left hand enucleating the gland while the index finger of the right hand in the anus elevates it (Fig. 2). Many urologists prefer that the assistant should elevate the gland, but the situation is best controlled by the surgeon himself.

ONE-STAGE SUPRAPUBIC PROSTATECTOMY

Secondary in importance only to pre-operative preparation of all patients, the change, during recent years, in methods of anæsthesia has contributed much to the safety of the operation of prostatectomy. The desirability of avoiding the inhalation types of anæsthesia has long been realized. Certainly the burden of general anæsthesia is not lightly borne by patients whose organic reserve is reduced incident to the average age and the result of prostatic obstruction.

Intraspinal anæsthesia obviates the disadvantages of general anæsthesia and provides complete relaxation and complete anæsthesia of the operative field. However, the reactions incident to disturbances of blood pressure make one question whether it is entirely safe. The method has been extensively used and highly recommended in this field of surgery by Chute, Gardner, and others. It remained for Labat to popularize in this country a method of regional anæsthesia, recently modified by Lundy (Figs. 3 and 4), which provides complete anæsthesia of the operative field. This method possesses none of the disadvantages of general anæsthesia and is devoid of the potential dangers of intraspinal administration. Sacral anæsthesia in skilled hands but rarely requires the supplementary aid of any other method.

The incision through the median line extending from the pubes to within four-fifths of the dis-

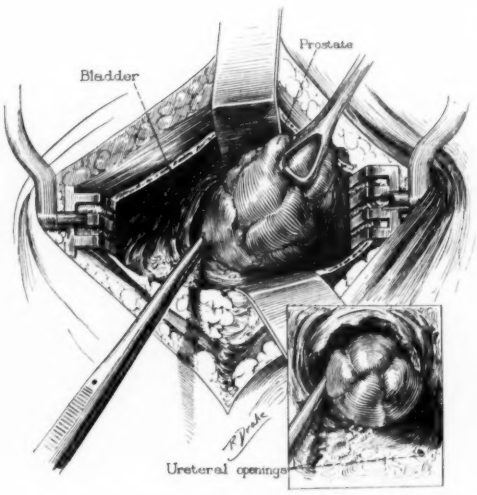

Fig. 7. One-stage suprapubic prostatectomy. The gland is elevated into the bladder by means of prostatic forceps as the instrumental enucleation proceeds.

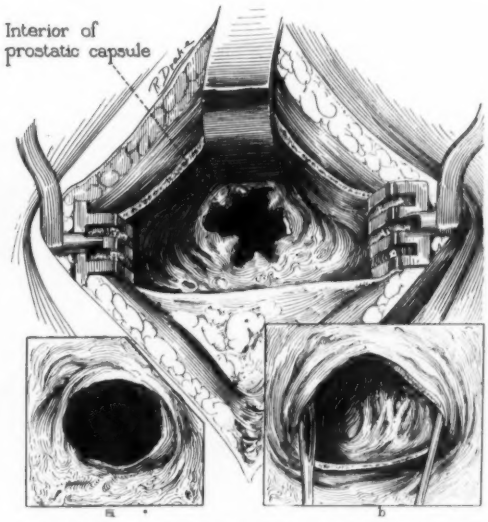

Fig. 8. Treatment of the vesical defect. In the unexposed operation irregular tags of mucous membrane may persist to become agglutinated and form a diaphragm with subsequent obstruction at the vesical neck. This is obviated by obtaining the exposure of the one-stage operation and incising the mucous membrane with scissors before the enucleation, or trimming off the tags immediately after removal of the gland. *a*, At the completion of the operation the neck of the bladder should present a clean cut circumference devoid of irregular laceration or tags of mucous membrane; *b*, inspection of the interior of the prostatic capsule after removal of the gland insures against the oversight of persisting adenomata or fragments of gland tissue.

tance to the umbilicus (Fig. 5, *a*) provides adequate exposure for the one-stage visible operation. The reflection of the peritoneum and preperitoneal fat is variable; however, it is readily stripped off the dome of the bladder (Fig. 5, *b*). Many surgeons distend the urinary bladder with air or irrigating solution. This possesses no merit except as an aid in identifying the bladder, for which purpose it is not necessary, as identification is readily made by the longitudinal muscle fibers. Distending the bladder with water or other solution only favors the dissemination of infective material around the operative field when the bladder is incised, and is inimical to the favorable healing of wounds. The insertion of the bladder retractor allows examination of the interior of the bladder and enables one to see the entire procedure of removing the gland (Fig. 5, *c*). As the first step in the actual removal of the gland, the mucous membrane around the internal urethral orifice or that overlying the intravesical part of the prostate is carefully incised with scissors in order to avoid irregular laceration of the mucous membrane in the subsequent enucleation (Fig. 6, *a*). The absence of an anterior lobe favors establishing the cleavage plane for the enucleation in the anterolateral wall of the prostatic urethra, which may be established by the index finger, and then the enucleation completed with the finger or instrument throughout the entire circumference within the capsule (Fig. 6, *b*). In cases of adenomatous hypertrophy the cleavage plane is very definite and entirely within the capsule of the gland; it is most readily established anteriorly and when accurately obtained favors the enucleation of the entire adenomatous enlargement of the median and lateral lobes intact, and at times with the entire circumference of the prostatic urethra (Fig. 7). In approximately 15 per cent of the cases, prostatic obstruction is the result of inflammatory enlargement of the gland, so-called prostatitis, in which a distinct cleavage plane does not exist. The visible operation makes possible a careful excision with scissors of the gland or its obstructing portion.

Inspection of the prostatic capsule is essential to make sure that small adenomata do not persist (Fig. 8). Such adenomata have been known to continue to grow and produce obstruction so that subsequent removal is required.

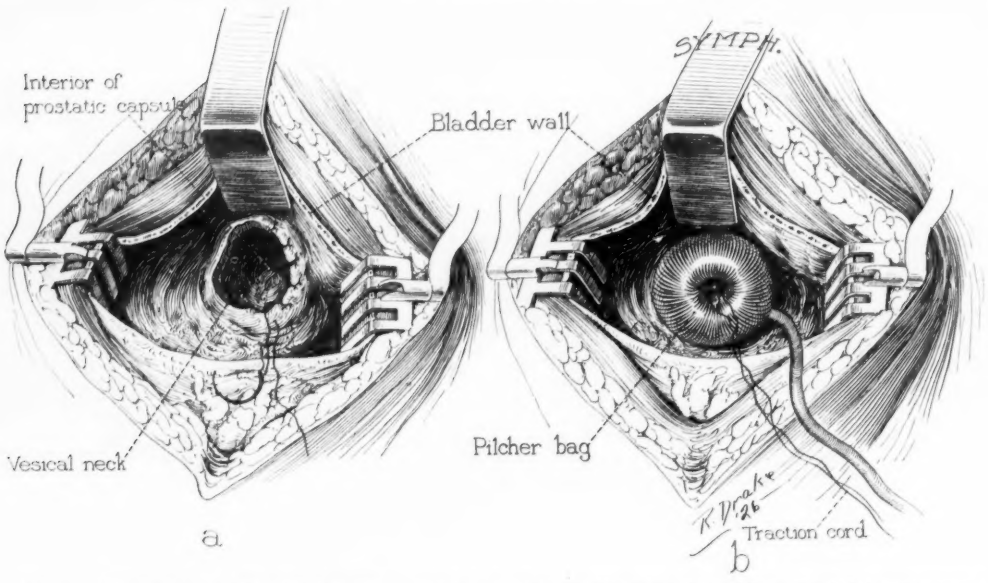

Fig. 9. Hæmostasis. *a*, Bleeding from the vesical neck after prostatectomy is readily controlled by interrupted sutures; *b*, the Pilcher bag is not drawn entirely into the prostatic capsule, but is allowed to impinge on the vesical neck. In this position it supplements the sutures; and traction necessary to maintain the bag in place is exerted on the internal sphincter instead of the external sphincter.

HÆMOSTASIS

Accurate control of bleeding is absolutely essential to the safety of the operation. Numerous ingenious methods of providing hæmostasis following prostatectomy have been advocated. Massage of the prostatic capsule immediately after removal of the gland has to some extent controlled bleeding from the interior of the capsule. The capsule has been irrigated with hot liquids, such as boiling water, boric acid solution, and hot bichloride solution, probably first suggested by McGill in 1888. Various tampons inserted into the prostatic capsule and methods of suturing the capsule have accomplished a certain degree of hæmostasis. Thromboplastic substances, chiefly kephalin, have served to reduce postoperative bleeding. Before the advent of the Hagner bag and Pilcher's modification of it, probably the most effective means was to pack the prostatic capsule with iodoform gauze and allow it to remain in place several days. While gauze has usually been effectual its effectiveness is the result of the gauze becoming enmeshed in the granulation tissue of the capsule. When it is removed, bleeding of variable degree is often precipitated and occasionally severe secondary hæmorrhage occurs.

The bag presented by Hagner answered a distinct need and serves as an excellent means of hæmostasis within the prostatic capsule. Pilcher's modification of the Hagner bag is likewise a most effective method of hæmostasis. The bag is usually adequate in controlling bleeding not only from the capsule but from the vesical neck as well. Judd and Cabot were the first to advocate interrupted sutures at the vesical neck to control bleeding, and hæmostasis is most complete when the sutures are used in conjunction with the bag (Fig. 9, *a* and *b*). Trauma to the urethra by the use of a special sound in the introduction of the bag is obviated by passing a urethral catheter as a guide for the sound which may be passed before the urethral tube is attached. The urethral tube of the bag is withdrawn attached to the sound and the bag drawn into place (Fig. 10), impinging on the vesical neck or internal sphincter rather than passing entirely into the prostatic capsule, so that it may supplement the sutures in control of bleeding at the vesical neck, and the traction on the bag may be exerted on the base of the bag at the vesical neck rather that at the apex of the bag on the external sphincter (Fig. 11). The bag is distended with water to the point of complete hæmostasis. The amount of disten-

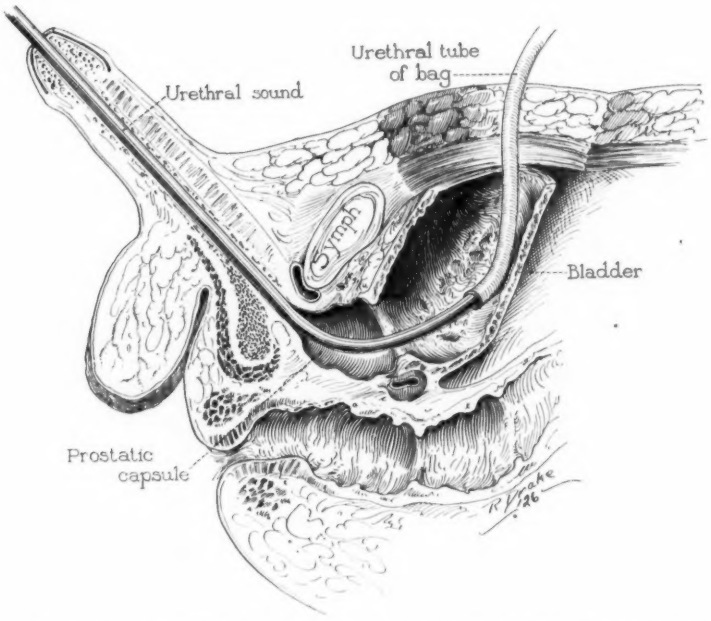

Fig. 10. Introduction of the Pilcher bag. The urethral tube of the bag is attached to the special urethral sound by which the bag is drawn into the prostatic capsule on withdrawal of the urethral sound.

tion necessary is not constant, but varies with the size of the prostate and the size of the capsule after removal of the gland. Excessive distention of the bag is not essential to the complete control of bleeding and may exert a harmful effect on the sphincters of the bladder; over-distention of the bag may cause it to thin out in one portion with subsequent rupture and defeat of its purpose. Distention of the bag to the point of hæmostasis exerts a pressure within the bag of about 140 millimèters of mercury.

Traction is necessary to retain the bag in place. Direct traction on the urethral tube of the bag is exerted on the apex of the bag and in turn on the external sphincter, thus jeopardizing its subsequent function. To avoid injury to the external sphincter traction is best directed on the base of the bag and on the internal sphincter by means of a silk strand passing through the urethral tube and attached to the ring in the base of the Pilcher bag. This strand is also attached to the ring of the Hamer tripod (Fig. 12). By virtue of the unchangeable distance between the bag and the point of fixation of traction a constant and unvarying degree of traction is maintained.

With complete hæmostasis suprapubic drainage is maintained only while the bag is in position. A No. 30 male catheter provides adequate drainage and allows a sufficient opening on its removal for the suprapubic withdrawal of the collapsed bag. The bladder is snugly closed about the suprapubic tube of the bag and catheter with plain catgut (Fig. 13, *a*), the first row approximating the edges of the mucous membrane and the second row approximating the edges of the muscle in the bladder wall. The fascia is closed with chromic catgut and the skin and subcutaneous tissues approximated with interrupted silkworm sutures. It is advisable to drain the extravesical space for 48 hours with a split tube (Fig. 13, *b*).

POSTOPERATIVE MANAGEMENT

The use of regional anæsthesia allows the continuation with little interruption postoperatively of the pre-operative regimen as regards diet, administration of liquids, and so forth. A competent special nurse is essential to the best postoperative care for at least the first few days in all cases.

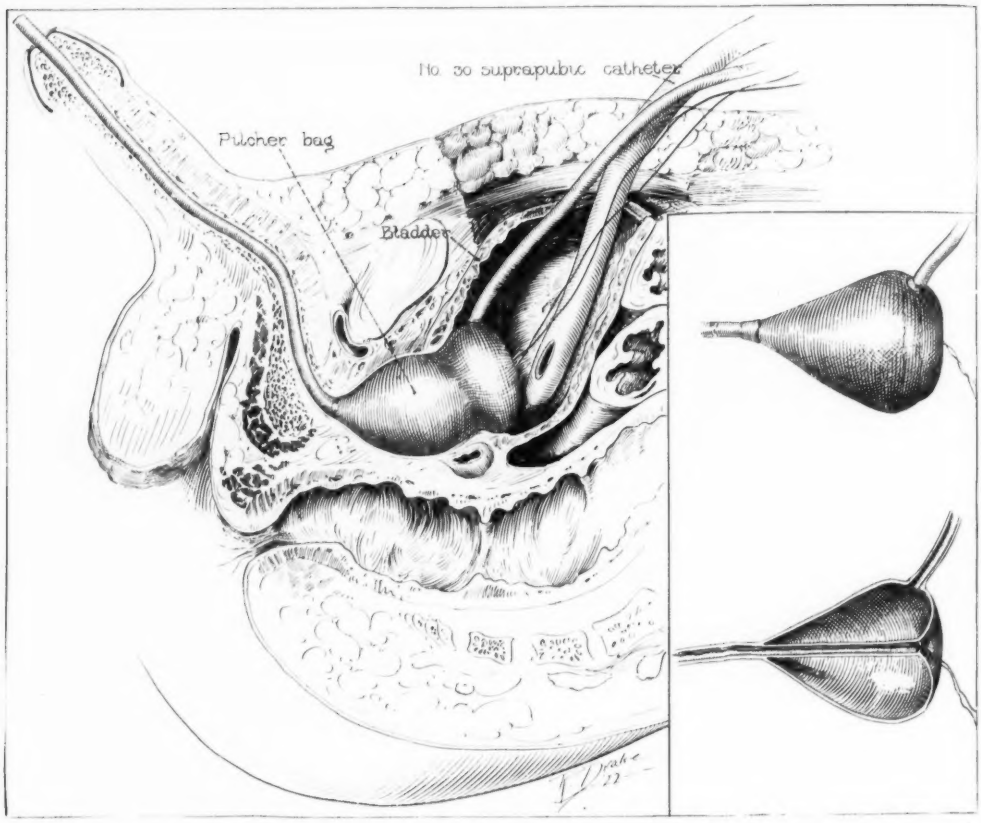

Fig. 11. Pilcher bag in position. The Pilcher bag when inflated conforms to the contour of the prostatic capsule, irrespective of its size. The amount of distention necessary varies with the size of the capsule, but should never be more than sufficient for complete hæmostasis. A No. 30 male catheter provides suprapubic drainage only for the time that the bag is in place.

The pre-operative management and preliminary treatment of actual or potential uræmia eliminate the probability of postoperative uræmia. They have restored the renal reserve to normal or to normal limits, obviating the necessity for postoperative stimulation of elimination by means other than the kidneys, so that the drastic use of saline cathartics is avoided. A liquid intake of at least 3,000 cubic centimeters daily is maintained and in most instances rectal or subcutaneous administration is not required.

Considerable difference of opinion exists regarding the length of time the bag is required. In most instances 6 hours is probably long enough and there may be little reason for prolonging the time beyond 12 hours. However, deflation of the bag 12 to 16 hours after operation insures the greatest safety from secondary bleeding, In about 4 per cent of cases, even after this length of time, reinflation for several additional hours is necessary. After deflation of the bag, it is allowed to rest in place for several hours to insure against secondary bleeding, at which time the withdrawal of the suprapubic catheter provides a sufficiently large opening for the ready removal of the collapsed bag. Immediately preceding removal of the bag a No. 20 male catheter is attached to the urethral tube of the bag and drawn into the bladder as the bag is removed. The urethral catheter subsequently provides drainage of the bladder and is maintained in position by adhesive to the penis. It is not necessary to maintain

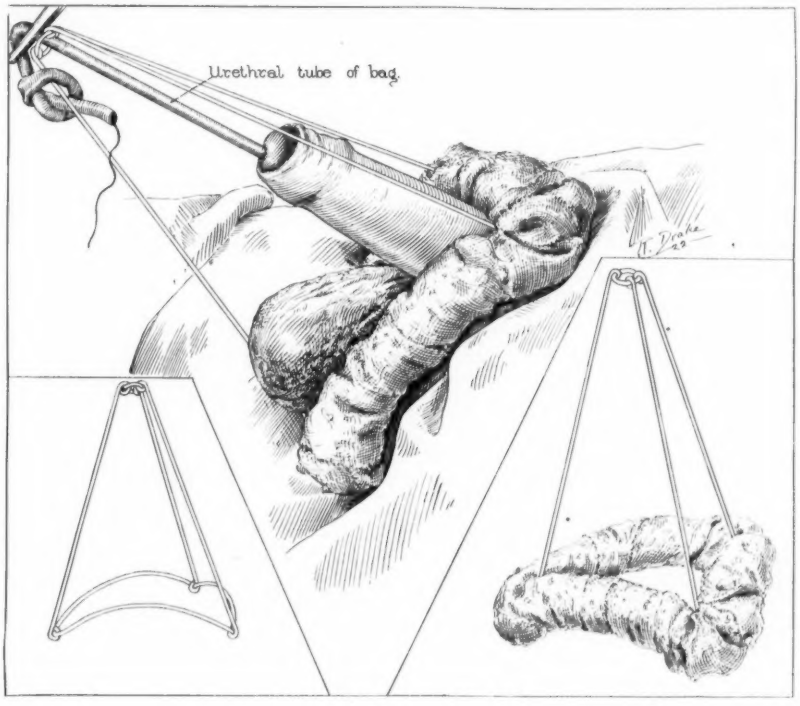

Fig. 12.

Fig. 12. Traction on bag. The Hamer tripod provides a method of maintaining an unvarying degree of traction on the bag. The traction is exerted upon the silk strand passing through the urethral tube of the bag to its base and not upon the elastic urethral tube and in turn upon the external sphincter.

Fig. 13. Closure of the wound. *a*, The bladder is snugly closed about the suprapubic tube of the bag and the catheter with plain catgut, the first row approximating the edges of the mucous membrane and the second row approximating the edges of the muscle in the wall of the bladder. The catheter upon its removal allows a sufficiently large opening through which to withdraw the collapsed bag readily; *b*, the skin is closed with interrupted silkworm sutures.

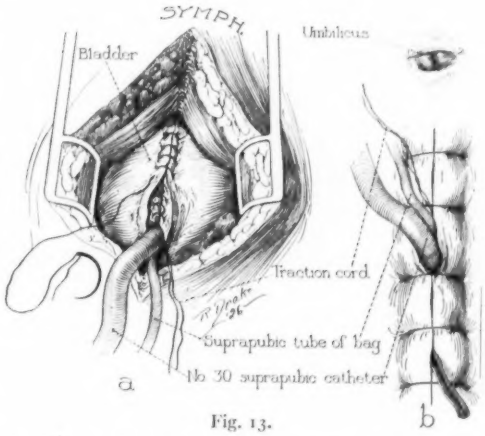

Fig. 13.

prolonged suprapubic drainage when hæmostasis has been accurate and complete. It prolongs healing of the wound unnecessarily and delays the establishment of urethral urinary function. The urethral catheter is maintained in position from 10 to 14 days, by the end of which time the suprapubic wound in most instances is healed; on withdrawal of the catheter voluntary urethral urination occurs. This method of drainage obviates a persistent suprapubic urinary sinus, reduces the length of time in hospital to a minimum, and is followed by excellent functional results.

There is little reliable evidence to support the contention that the judicious use of the urethral catheter before and after operation contributes

to the incidence of epididymitis. Epididymitis occurs in a variable percentage of cases; its greatest incidence is not during convalescence in hospital, but after the third month, and is in all probability due to cicatricial contraction about the ejaculatory ducts with resultant retention and infection ascending to the epididymis.

Some difference of opinion exists regarding postoperative irrigation of the bladder. It seems that it contributes little to the welfare of the patient and it may do harm by precipitating secondary bleeding. However, the daily installation of a 1 per cent solution of mercurochrome seems to possess some merit.

SUMMARY

The successful management of the patient with surgical prostatic obstruction demands meticulous care in the pre-operative, operative, and postoperative procedures. The pre-operative treatment in all cases most successfully combats actual or potential uræmia and provides opportunity for improving the cardiovascular-renal reserve. The visible operation insures the patient against surgical accidents, and the use of regional anæsthesia is devoid of depressant effect on the kidneys and obviates the occurrence of the post-operative pulmonary complications incident to the inhalation anæsthetics.

FROM THE CLINIC OF ROVSING, UNIVERSITY OF COPENHAGEN

THE TECHNIQUE OF MY METHOD OF ANTETHORACIC ŒSOPHAGOPLASTY

By THORKILD ROVSING, M.D., Copenhagen

IN the last 20 years, the attention of surgeons has been very extensively occupied with the problem of making a new œsophagus by a plastic operation, especially the problem of helping the patient suffering from a benign stricture of the œsophagus caused usually by swallowing caustics. In most of these cases the stricture can be relieved or the œsophagus kept open by the introduction of bougies; but the patient very often returns soon with a bad recurrence, the passage of bougies having become more and more difficult and at last quite impossible. The patient becomes emaciated and we are forced to make a gastrostomy to keep him alive. Such a gastrostomy is really a wonderful help at first, but added to the fatigue and depression it causes, it does not afford the possibility of sufficient nourishment to the hard working man.

In 1907, the well known surgeon, Roux of Lausanne, perfected the method of "antethoracic œsophagojejunostomy" which had been theoretically proposed 3 years previously by Wullstein. This is a very complicated operation. A 40 to 50 centimeter loop of jejunum is excised and its caudal lumen implanted into the stomach, while the oral lumen is drawn through a subcutaneous channel in front of the sternum up to the jejunum where in a second stage it is united with the upper healthy part of the œsophagus.

This operation is very dangerous for several different reasons:

1. The risk of peritonitis is great because a patient who has already been subjected to a long-standing gastrostomy must submit to a very complicated intraperitoneal operation. The skin around the gastrostomy is often ulcerated and irritated and is difficult to clean. The presence of the gastrostomy leaves a narrow and difficult space for the laparotomy, therefore the contents of the stomach enter the cavity and soil the wound.

2. The nutrition of the transplanted loop of jejunum is very poor and is easily interrupted by torsion of the small pedicle of the mesentery or by compression between the skin and sternum, with the result that the new œsophagus becomes totally or partly gangrenous.

Hence the many efforts to simplify the method!

Kel ing, Vulliet, and von Hacker used the transverse colon thinking it would be more mobile and better nourished than the jejunum. I think that the greater risk of septic infection from the contents of the colon outweighs the advantages.

To me, the most reasonable modifications are those in which the stomach itself is used as a transplant.

Von Fink (1913) severed the duodenum near the pylorus, closed the caudal part, and drew the central stump of the duodenum and stomach up under the skin to meet the cervical part of the œsophagus. A simultaneous gastro-enterostomy was of course a necessary supplement.

Kirschner, fearing the antiperistalsis, made use of the opposite end of the stomach, cutting it at the cardiac end and drawing the cardiac part up between the sternum and skin to meet the œsophagus. Here it was necessary to make an anastomosis between the jejunum and cardia.

Less dangerous is the method of Jianu who makes a new œsophagus of the greater curvature of the stomach. By two parallel incisions a long flap is dissected free from near the pylorus up to the fundus of the stomach. The stomach wound

Fig. 1.

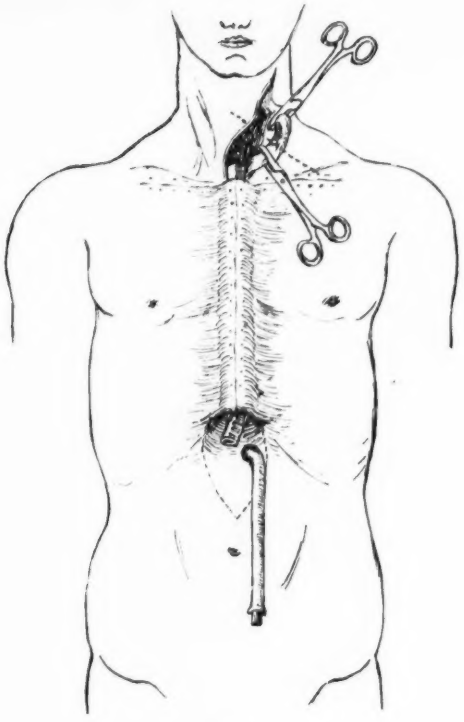

Fig. 2.

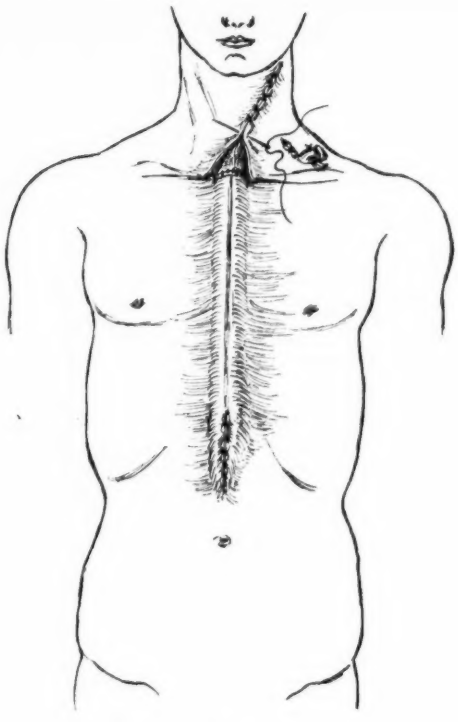

Fig. 3.

is closed up to the base of the flap, where a new cardia is formed by uniting the borders of the flap to a channel which is then drawn up as an antethoracic gullet.

This method has three questionable features: (1) the long suture line; (2) the possible delay in healing caused by the action of hydrochloric acid and pepsin which is produced by the mucous membrane; and (3) possible antiperistalsis.

I beg to remark that all these dangers and difficulties of the different methods are the result of the conviction that the new gullet must be capable of peristaltic motion. *Is this true?* This is the question I have put before myself thinking that if peristalsis were not necessary we could form the new gullet without all the mentioned risks by a simple skin plastic. The answer was not difficult, many facts showing me that peristalsis is not at all necessary.

I noted that in most successful cases, the peristalsis, if present at all, very rapidly disappeared whether the new œsophagus was formed from the jejunum, colon, or stomach; and this fact is not surprising because the transplant grows very intimately together with the surrounding tissue.

Moreover, Gluck's and Torek's cases show that a simple rubber drain uniting an œsophagostomy with a gastrostomy will function for years in a very satisfactory manner. In Torek's famous successful case of resectio œsophagi, his patient, an elderly woman, was still alive 10 years after he extirpated the cancer.

These considerations led me to work out the following more simple and less dangerous method which I have performed successfully in 4 cases. All 4 patients are now cured and very happy. The first patient, whose history was published in *Hospitalstidende* for January, 1923, was operated upon February 17, 1921.

TECHNIQUE OF THE OPERATION

First stage. Gastrostomy. The laparotomy incision extends from the ensiform process 6 to 7 centimeters downward in the center line. Two silk threads are caught in the serosa of an area of the anterior stomach wall about the size of a dollar

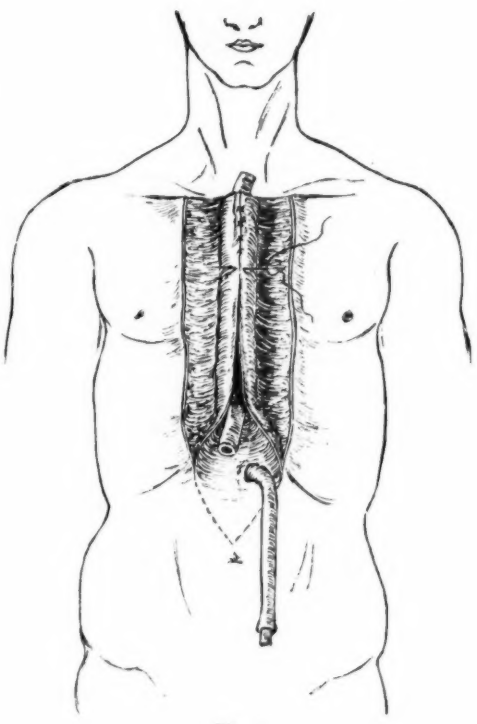

Fig. 4.

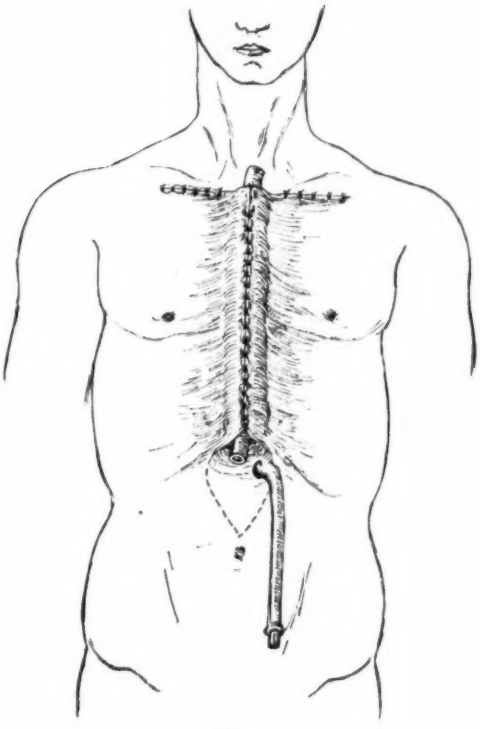

Fig. 5.

situated far enough up so that it can be freely drawn out and sutured to the parietal peritoneum. Just at the point where the two central silk threads are brought out, I make an incision in the left rectus muscle from its inner border outward, cutting cautiously half through the muscle. The peritoneal cavity having been closed by a series of silk sutures in the periphery of the dollar-size area of stomach wall, I put traction on the two silk threads so that the stomach is drawn up in a cone shape, and having protected the surrounding surfaces of the wound, I open the stomach with a small incision between the two silk threads and dilate the opening with small blunt forceps just enough to admit the largest size Pezzer drain. The button of the Pezzer drain is fastened tight to the anterior wall of the stomach so that not a drop of fluid can get out by the side of the drain (Fig. 1).

At last the aponeurosis and the skin below and above the Pezzer drain are each sutured with aluminum-bronze wire and the suture line is protected with collodion and absorbent cotton. Sterilized fluid food can, if necessary, be administered immediately after the operation

Second stage. As soon as the patient has regained sufficient strength to stand a new operation, I perform an œsophagostomy. Through an oblique incision along the anterior border of the sternocleidomastoideus, I dissect the œsophagus free far enough so that I can run a finger around it and lift it up to the incision in the skin. Between two tongs I cut the œsophagus through. The inferior end is then brought out through the small incision in the left supraclavicular fossa, fixed here to the skin by silk sutures, and drained with a tight rubber drain to exclude every danger of mediastinitis. The oral end of the œsophagus is very accurately sutured to the skin in the lower part of the oblique incision, the rest of the œsophagus above the œsophagostomy being closed in the usual manner. A rubber tube is introduced from the mouth into the œsophagus and led out through the œsophagostomy (Figs. 2 and 3).

Third stage. When the œsophagus is entirely healed to the skin and easily permits the passage

of food, I measure the circumference of a thick rubber drain of just the size I want the new œsophagus to be. This measure represents the distance between two parallel incisions of the skin on the thorax from which I dissect the skin free inward so far that it can be united in the central line around a drain one or two sizes smaller than the drain the measure of which I used as an indicator for the distance between the two incisions. Otherwise it might be difficult later to remove the drain. At the upper end, the two skin incisions are made to meet each other above the œsophagostomy. At the lower end the two parallel incisions are not made to meet each other around the gastrostomy as it must be kept open until the upper part of the antethoracic œsophagus is quite healed. The lower ends of the incisions correspond to the plane of the gastrostomy. Outward the skin is bluntly loosened or, if this is impossible, dissected free from the fascia and mobilized sufficiently so that the two lateral edges of the incision can be united in the median line. With women this is usually easy to do, but with men and emaciated children, it may sometimes be necessary to make some relaxing incisions. The wounds are covered with nitrate of silver, gauze, and absorbent cotton. The œsophageal drain is brought down into a low-placed glass receptacle (Figs. 4 and 5)[1].

Fourth stage. When the wound is well healed, the Pezzer drain and the œsophageal drain are removed, the gastrostomy closed, and the two parallel incisions made to meet each other around the œsophagostomy (Fig. 3).

My experience with this method convinces me that it represents an important step in the progress of the operative treatment of these very difficult and serious cases. The method reduces the risk to a minimum, giving as good functional results as the old very dangerous methods.

The only dangerous moment is when we are cutting the œsophagus cervicalis through, but I find this quite necessary. A side opening in the œsophagus is insufficient for the outward passage into the skin tube, and permits the food to enter the cul-de-sac above the stricture where stagnation, decomposition, and inflammation may take place. It is much better to drain this cul-de-sac thoroughly, as is done by my method which insures perfect cleanliness.

[1] In my first case the œsophagostomy was the third stage, the antethoracic skin-tube the second stage; hence the incongruity which the reader may have remarked between the description and the illustrations which were made after the first operation.

ATRESIA ANI VAGINALIS, ITS CORRECTION

WITH REPORT OF A CASE[1]

BY NORMAN F. MILLER, M.D., ANN ARBOR, MICHIGAN
Assistant Professor in Obstetrics and Gynecology, University of Michigan

ATRESIA ani vaginalis is not a common condition. The incidence of the lesion is not definitely known, but an idea of its frequency may be gained from the knowledge that anal or rectal malformations of some type or other occur once in every five to fifteen thousand newborn infants and that atresia ani vaginalis is one of the most common of these lesions. Bickham (5) believes it to be the most common type of anal deformity in females. No doubt the frequency is even greater than the above figures would indicate, since some cases are practically symptomless and, undoubtedly, pass through life unrecorded.

In this type of anal deformity the normal anus is absent. In its place there may or may not be a dimple or depression marking the normal anal site. The rectum, instead of opening through the anus, terminates directly or through a fistulous tract in some portion of the vagina. This opening is generally low, the vaginal fourchette being a common location. Although the opening may be in any portion of the genital tract, a higher opening is less frequently seen. As might be expected, the higher the opening the more severe the symptoms and the more difficult the treatment.

The condition is due to a developmental defect. During the first few months of intra-uterine life the ectoderm at the normal anal site invaginates preparatory to uniting with the down pouching of the hind gut or what becomes the rectum. This normally occurs by the twelfth week of fetal life. Incomplete development or non-union in this process results in imperforate anus. While some of these individuals show a distinct but imperforate anus, others reveal no evidence of the normal anal site, as in the case to be reported. During these early weeks of development the cloaca functions as the common outlet for both intestinal and urinary tracts. Synchronous with the union of the hind gut and anal indentation as mentioned, a division, or partitioning of the cloaca normally occurs. This partition later becomes the rectovaginal septum. When, however, this partitioning process is incomplete and non-union of the rectum and anus occurs, atresia of the anus with a rectovaginal fistula or atresia ani vaginalis results.

Various causative factors have been advanced to account for this lack of development. Prominent among these are poor blood supply, adhesions, and inflammation. Heredity, it would seem, plays no part in the etiology of the condition, although Ayer (2) reports two children of the same family afflicted with the condition. Smiley (14), on the other hand, reported a woman with atresia ani vaginalis who gave birth to a normally developed infant.

The symptoms produced by atresia ani vaginalis vary considerably. Much depends upon the location, size and existence of the sphincteric fibers around the opening. When the opening is large, no symptoms may be apparent until later in infancy. The irregular escape of fæces and gas is not unexpected and in infancy does not suggest anything particularly abnormal. Should the opening be small, however, symptoms may appear after the first few days of birth. The child may have no difficulty in passing the soft meconium, but as time goes on the normal fæces may produce considerable difficulty as revealed by severe colic and constipation. These symptoms may increase until symptoms of true obstruction occur, as in a case reported by Fitzgerald (7). The mother was unaware of her daughter's condition until the child was 2 months old. Difficulty in normal evacuation had become more and more marked and constipation more prominent until finally the mother investigated and found the above condition. When the opening is large and control is exhibited by the existence of sphincteric fibers in the surrounding tissue, there may be no symptoms at any age. Such individuals may pass through life unconscious of their deformity. Morgagni (quoted by Brenner, 6) reported such a case, a woman who lived to be over one hundred years of age, who bore children, yet was never aware of her unique condition. When the opening is small, symptoms are apt to appear early, although the symptoms are seldom acute. Constipation, colic, vomiting, tympanities, and more rarely serious symptoms of obstruction are present. In older or neglected cases, impaction of the bowel with fæces produces an enormous distention of the rectum, lower large bowel, and abdomen.

[1] From the Department of Obstetrics and Gynecology, University of Michigan.

Fig. 1.

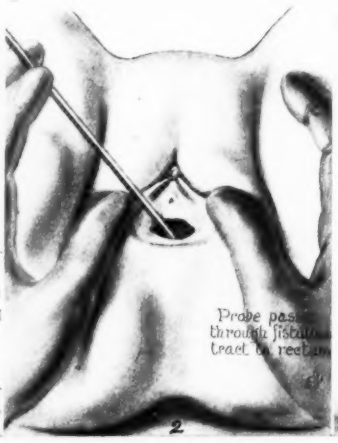

Fig. 2.

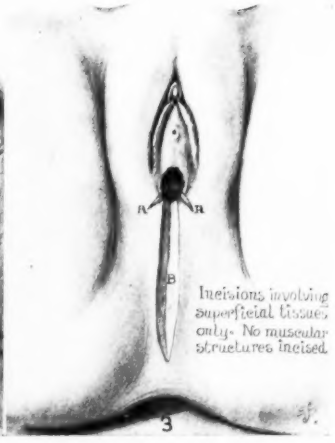

Fig. 3.

Frequent watery stools with incontinence occur, due to the drastic catharsis generally necessary in these individuals and to the canalization of the impacted fæces. Flatulence was not a prominent symptom in the case to be reported. Headaches, malaise, muddy complexion with symptoms of chronic obstruction are to be expected in the more severe or long standing cases. At its best the condition produces much discomfort and suffering. While the physical suffering is of greater importance, the mental anguish of individuals thus afflicted and old enough to understand their condition must not be overlooked. Disregarding the physical pain and discomfort, the constant and uncontrollable leakage of gas and fæces forces the already reticent individual farther into the social background, and she becomes in fact, if not in theory, socially ostracized.

Marriage, in uncorrected cases, except in very exceptional instances, is contra-indicated. Should marriage be contemplated, the potential dangers from infection at the time of confinement must receive serious consideration. Where some semblance of control exists through the presence of sphincteric fibers, the mental and physical suffering is no doubt greatly diminished, but few patients thus afflicted show any evidence of bowel control.

For immediate treatment in the newborn, simple dilatation is generally satisfactory. In fact, no further treatment should be instituted until the age of puberty is reached. This point has been stressed by many observers. Operation, previous to puberty, upon the undeveloped structures of the infant or child is not satisfactory and an efficient result cannot be expected. Furthermore, the dangers of operation in infancy being greater than at puberty, render it unwise to subject the child to such unnecessary risks.

Operation, unfortunately, does not always result in complete cure. The immediate results have generally been good, but control has been poor or remained entirely absent. Then, too, due to the extensive dissection with the formation of scar tissue, a gradual narrowing of the lumen not infrequently occurs requiring frequent dilatation. Prolapse of the bowel occurs, due to absence of sphincteric support and to the cone-shape of the anal opening. Regardless of the incomplete cures in these individuals, operation still offers much in the way of relief. The mere fact that a distinct and separate anal orifice is established is, in itself, an improvement and a welcome relief to the afflicted individual.

Operative treatment has consisted in an attempt to bring the lowest portion of the rectum down to the perineum where it was opened and fixed to the skin edges. The vaginal opening was then closed, but usually broke down or it was left to close of its own accord, as it frequently did when a normal anal opening was established. This procedure was often difficult. Extensive dissection was frequently necessary to reach the lowest portion of the rectum and, when reached, it was often impossible to bring the rectum down to the skin surface. Rizzoli (12), in 1856, first devised a satisfactory method of treating the lesion with a low or vulvar opening. Later, in 1865, he reported three cases with vulvar openings treated

Fig. 4.

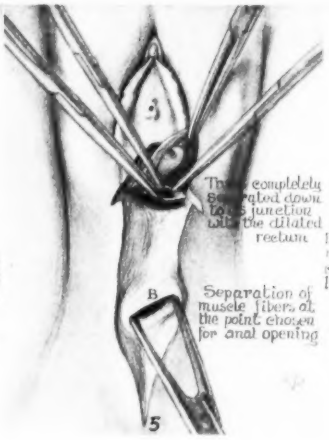

Fig. 5.

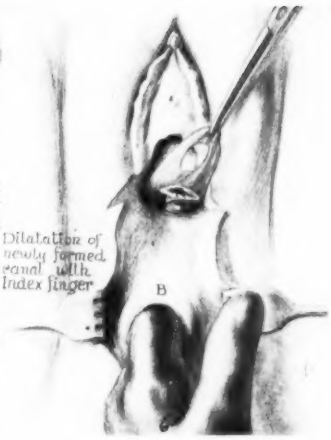

Fig. 6.

by his method. His procedure was to incise the skin and superficial tissues between the rectal opening at the posterior fourchette and the coccyx, then reflect the two flaps laterally and, by dissection, free the rectal opening. The opening was then transplanted from the vulvar region down near the coccyx. The operation was completed by fixing the opening to the skin edges, approximating the superficial tissues, and closing the cutaneous flaps. His results, apparently, were successful. When the opening is higher, more difficulty is encountered and, as previously mentioned, ultimate cure is not always obtained, because of the inability to obtain good sphincteric control and because of the narrowing of the lumen due to the extensive scar and cicatricial contraction. When sphincteric action exists in the tissue surrounding the rectovaginal opening, much may be accomplished in the way of preventing incontinence after operation by the use of the procedure suggested by Gant (8) and others. A considerable portion of the tissue surrounding the rectovaginal opening, with the sphincter fibers existing in this region, is included in the transplant. When no sphincteric function has been present, the operator must devise a remedy for this deficiency in addition to forming a normal anal outlet or opening. The method utilized by the writer in the correction of the case here reported would seem to offer the best chance for complete sphincteric control later, as well as the least possible contraction due to scar tissue formation.

Miss G. T., case No. 18308, age 15, was examined in the out-patient department of the Obstetrical and Gynecological clinic at the University Hospital on August 12, 1924. Examination showed a well developed, intelligent girl of 15, in fair health except for her complaint of constantly passing small amounts of semisolid fæces through the vagina and the difficulty of obtaining a thorough evacuation. Her complexion was good and clear. General examination was essentially negative, until the abdomen was investigated. This revealed an enormous distention of the entire lower portion rising almost to the rib margin on the left. There was no muscle spasm and no particular tenderness on examination. Palpation gave a doughy sensation throughout the entire area. The mass followed the outline of an enormously distended large bowel. Vaginal examination revealed an unruptured hymen, but examination was made without particular difficulty. The cervix and uterus were carried high up to the right and the entire pelvis was filled with a boggy and doughy, distended rectum. The appendages could not be felt. The examining finger could only be passed up behind the pubis, because of the marked anteroposterior flattening of the vagina. Careful investigation revealed an opening large enough to admit the finger tip lying more than one inch inside the vagina in the posterior wall and slightly toward the left. The vagina and rectum were connected by a fistulous tract approximately one and one-quarter inches in length as revealed by introducing a sound and later the examining finger. No anus was present. Not even a dimple existed to show the normal anal site. So far as could be determined, the distance between the skin surface at the normal anal site the lowest portion of the rectum was approximately one and one-half inches.

History revealed no particular difficulty during early life, but for the past few years she had noticed more and more difficulty in obtaining bowel evacuation, even with cathartics. There was constant escape of gas and liquid fæces. The abdomen had become very much larger and hard, but there was no particular pain. No control of the bowel had existed at any time. Menstruation had begun 1 year ago and had been normal until recently, when it was accompanied by pain and backache.

It was thought that many operative difficulties might be avoided if the lower bowel could first be thoroughly evacuated. With this in mind a colostomy was attempted. The operation was never completed because of the impossibility of bringing even a small portion of the enormously distended colon up through the wound.

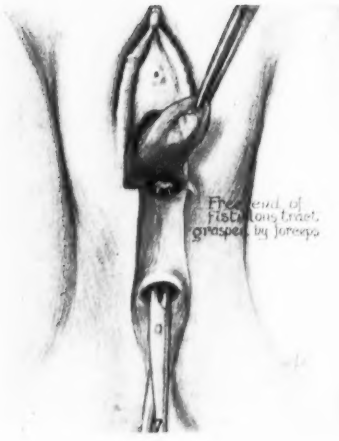

Fig. 7.

Fig. 8.

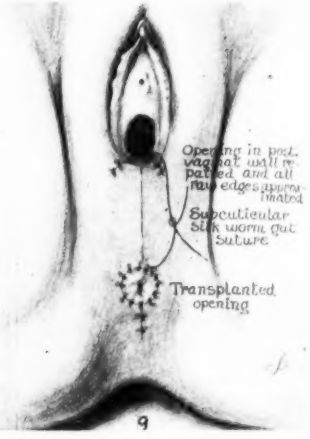
Opening in post. vaginal wall repaired and all raw edges approximated
Subcuticular Silkworm gut suture
Transplanted opening

Fig. 9.

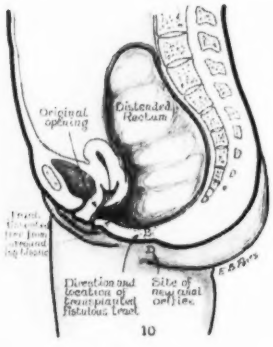

Fig. 10.

The abdominal incision, however, permitted palpation of the pelvic viscera. The uterus, tubes, and ovaries were well developed and entirely normal, except for the marked displacement to the right, as previously mentioned. For a period of 3 weeks following this attempt, strenuous efforts were made to evacuate the lower rectum through the recto-vaginal opening by means of small enemata. At the end of this period, though the lower rectum was slightly diminished in size, the remainder of the bowel remained unchanged.

On September 12, 1924, a second operation was performed and the deformity corrected as follows: An incision was made from the vaginal fourchette to the tip of the coccyx, through the skin and superficial tissue, no muscular structures being severed (Fig. 3, b). Two small incisions were next made in the lower lateral part of the vagina to give more room (Fig. 3 aa). A circular incision was next made about one-eighth of an inch outside the rectovaginal opening in the posterior vaginal wall (Fig. 4). More tissue was not included since no control had been exhibited and, apparently, no sphincteric fibers existed in this region. The posterior vaginal wall, or mucosa, was then dissected free as in an ordinary perineorrhaphy (Fig. 4, c). After this the entire fistulous tract connecting the vagina and rectum was dissected free from the surrounding tissues by blunt dissection. This dissection was carried a little beyond the junction of the tract with the rectum proper (Fig. 5, a; also Fig. 10).

The patient was then permitted to react slightly from the anæsthetic and the perineum closely watched during the retching which followed. Definite sphincteric activity was noted at the normal anal site. The contraction was not violent, but very distinct. A blunt hæmostat was introduced in the center of this region and carried up to the junction of the fistulous tract and rectum (Fig. 5). No muscle fibers were cut. The finger was next introduced through the passage formed by the hæmostat, and the newly formed canal thoroughly dilated (Fig. 6). The vaginal opening of the fistulous tract was then grasped with a clamp and carried down through this newly formed muscular tunnel to the site of a normal anus (Figs. 7 and 8). The anal opening was then fixed to the skin edges. This was facilitated by excising a semicircle of skin on either side. The opening in the vaginal flap and the space left by transplanting the fistulous tract were closed. All raw edges were then approximated as in an ordinary perineorrhapy, a subcuticular silkworm suture being used on the skin edges (Fig. 9).

Recovery was uneventful. Thinking that dilatation might be advisable before the patient was discharged, an attempt to dilate the canal was made on September 26, 1924. This was found inadvisable, however, due to the short interval since the operation and the incomplete, though primary healing. The patient was, therefore, advised to return for this procedure in 2 months after union of the tissues was sufficient to stand the strain of stretching. The patient was discharged from the service October 11, 1924, with the advice to take a daily cathartic until the abdominal enlargement had disappeared.

Palpation on December 12, 1924, revealed a normal, soft abdomen, while rectal examination showed excellent healing and approximation of the mucosa and skin edges. The examining finger was introduced with but slight difficulty. The rectum beyond the junction with the fistulous tract seemed entirely normal. Vaginal examination revealed a

normal pelvis. There were no palpable masses and the pelvic viscera were in normal position.

On December 19, 1924, the anal passage was thoroughly dilated by means of Hegar dilators. At first control was only fair, but with constant effort to exercise and develop her sphincter muscle, which had so long remained functionless, improvement became rapidly apparent. Now the patient writes that she has good control and has two bowel movements per day. She has gained about 25 pounds in weight and is anxiously waiting for the time when she can take up nursing.

CONCLUSIONS

The procedure described seems to offer a simple and logical means of correcting atresia ani vaginalis for the following reasons:

1. Avoidance of extensive cutting tends to lessen scar tissue formation and contraction with narrowing of the anal canal.

2. The use of the fistulous tract for the anal outlet renders the procedure simple and practical.

3. Utilization of the apparently normal sphincter results in entirely satisfactory control.

4. The development of normal sphincteric support materially lessens the chances of rectal prolapse.

BIBLIOGRAPHY

1. Ashhurst. Univ. of Penn. Med. Bull., 1907-1908-1920, footnote p. 98.
2. Ayer. Boston M. & S. J., 1858, lvii, pp. 510.
3. Beck. Chicago Med. Recorder, 1901, Jan.-June, 478.
4. Bevan. Surg. Clin. Chicago, 1920, iv, 321.
5. Bickham. Operative Surgery, vol. v, pp. 91–92.
6. Brenner. Congenital defects of anus and rectum. Surg., Gynec. & Obst., 1915, xx, 582.
7. Fitzgerald. Brit. M. J., 1898, i, 945.
8. Gant. Diseases of the Rectum, Anus, and Colon, vol. i, p. 123.
9. Gaston. Internat. Clin. vol. iii, p. 217.
10. Hirschman. Handbook of Diseases of the Rectum, p. 67.
11. Quinland. Boston M. & S. J., 1922, clxxxvii, p. 875.
12. Rizzoli. Mem. d. Accad. Bologna, 1856, viii, p. 51.
13. Ibid., 1865, ser. 2, v, 213.
14. Smiley. J. Am. M. Ass., 1911, lvii, p. 2047.

THE FATE OF THE FRAGMENT—A STUDY OF COMMINUTED FRACTURES

By F. E. CLOUGH, M.D., F.A.C.S., Lead, South Dakota

MY object in choosing The Fate of the Fragment as my title is to bring out a discussion on the débridement method when applied to injuries received in civil life.

The plan of mechanically cleaning out wounds is not a new idea, as it is first mentioned in the writings of an Italian surgeon, Guy de Chauliac in 1363, as translated by W. A. Brennan of the Crerar Library, Chicago.

Débridement in the late war was first practised by the French and later adopted by all the Allies. Gas gangrene, the cause of death in thousands of injuries in the early years of the war, was found to be much less common if all badly lacerated or contused tissues could be quickly removed. Hence, it became the custom to excise if possible all questionable tissues during the first few hours after injury. Not only did the war surgeons find that gas gangrene was materially lessened but that all types of infections were cut down to a considerable degree. This meant that wounds which could be rendered mechanically clean at once and then vigorously treated with antiseptics, could either be closed by primary union or delayed primary union and the patient returned to work more quickly than if other methods were used. Hence, by cutting down the number of deaths from gas gangrene and diminishing the actual loss of time on account of injuries, a twofold economic problem was greatly relieved.

However, one must not forget that war time conditions were out of the ordinary. The physical state of the active soldier was better than that of the average citizen and helped him to offset the unsanitary surroundings under which he was forced to live and work. On the other hand, his intimate association with a highly infected and polluted soil made his chance for an infected wound far greater than would be that of the patient who received an average injury in civil life.

No one questions the fact that débridement saved many lives. On the other hand, if we admit that this method was often used to ward off infection, then we may raise the question as to whether or not the radical removal of all diseased soft parts and bone as well, did not materially prolong the period of convalescence and give end-results no more satisfactory than those obtained by other methods. After having seen returned to a base hospital in this country after the armistice, a multitude of fracture cases with enormous, sluggish wounds of bone and soft tissue still present, one wonders, if in the necessity for standardizing wound treatment, débridement had not been used somewhat more extensively than it would have been under other conditions.

If the main reasons for débridement in war surgery were to ward off gas gangrene and to diminish both the frequency and virulence of general infections, then, in civil life—the patient coming to the doctor within a short time after the injury and remaining under his care until healing is complete, and the probability of severe infection not being great—is the surgeon justified in radically removing not only all soft tissues which seem to have impaired life but all fragments of bone as well? If he is not justified in performing such radical measures, are there certain types of fragments which should be taken out while others are allowed to remain?

What becomes of the fragments in a simple, comminuted fracture?

In a badly comminuted, simple fracture the fragments often lie at all angles to the shaft, with sharp points close to the skin. From experience gained in operative work, one can say that some of the fragments are torn loose from their periosteal coverings, while others are completely detached from all soft tissues. The fact that their blood supply has been temporarily interfered with does not mean they should be cut down on and removed as useless foreign bodies. Rather, they should be manipulated and brought into as close line up as possible and immobilized in that position. Absolute anatomical reposition can rarely be obtained and is not necessary. Even though the alignment is not perfect, nature will eventually form solid union, will increase the compact tissue on the side carrying the bulk of the strain and will ultimately round off all projections, so that a good looking extremity will be found 2 or 3 years later. The formation of a sinus leading down to a sequestrum is a very uncommon occurrence following a simple fracture treated by closed methods.

The handling of a compound fracture is as much a soft tissue as a bone problem. In addition there is always the possibility of an infection entering which may cause trouble, although the number of

seriously infected compound fractures is relatively small if the fracture is treated soon after the injury is received.

Before discussing the fragment in other types of fractures, it is appropriate to outline our plan of handling compound fractures.

Attention is called to the fact that our injury cases reach us within a very short time after the accident, which makes a great difference in the percentage of infections. No time is lost in securing immediate reduction and immobilization. We believe that a delay of hours in order to secure X-ray plates or to get somebody to help is to be condemned. It is a rare thing in our service not to have the first reduction completed and the patient in bed within half an hour and much quicker in the majority of cases. It is of more than passing interest to mention that tetanus has never been seen in our mountainous country (altitude one mile), hence anti-tetanic serum is never administered, even though the wounds be contaminated with dirt.

First aid to the injured has been so well taught in our industry that no unprotected fracture reaches us. This is limited to the application of a sterile, non-medicated dressing and suitable temporary splints or the patient is fastened on a transportation stretcher.

The injured extremity is carefully held and the clothing is removed so that the two extremities may be compared. This is a most important point, especially from the medicolegal standpoint.

The wound is protected and the extremity is washed with soap and water, an æsthetic, if not a surgical requirement. From then on, the treatment depends upon in which of two groups the injury belongs. In the first group we have one or more small openings caused by a spicule of bone or the sharp edge of a fragment piercing the skin. If the surface of such a fracture is painted with iodine and the same drug poured into the wound, and if possible, a sterile dressing applied, the wound will soon become healed and the fracture can then be treated as a simple fracture.

In the second group, with large skin openings and lacerations and the loss of soft parts, a more serious problem is presented. In these cases every section of the wound should be thoroughly painted with iodine. It has been our policy to cut off all injured skin which looks bad but to be conservative about excising the underlying tissues, for we have found that time and again there would have been practically nothing left if all the injured tissues had been removed. We have occasionally seen soft tissues from which, when cut, no blood would flow, become viable and share in the processes of repair. Hence, in our service, we seem to have just as good or better results, when active soft tissue débridement is not carried out. If at the first sitting, one does not take out all questionable diseased tissue but waits for the presence of a line of demarcation, the end-results seem to be about as satisfactory. Therefore, we are not enthusiasts on the subject of débridement. In civil life, an infection in a compound fracture is rarely severe enough to cause death.

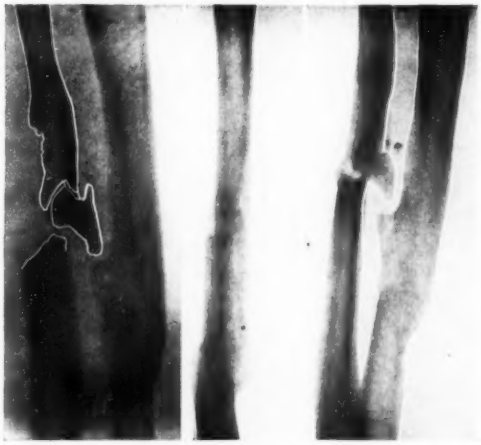

Fig. 1. J. O. Compound comminuted fracture of the forearm. Before union and after.

What is done to reduce the fragments?

The patient is immediately given a general anæsthetic, is placed on a fluoroscopic table and as perfect a reduction made as is possible. Here, manual dexterity counts for much. There is a certain knack acquired with long experience. Fracture reduction requires not only muscle power but brain effort as well. Angulation of the fragments will often work when the hardest kind of a direct pull is of little value. Finger pressure over a fragment or clasping the hands around the injured extremity and squeezing hard will often restore normal relations. Simple instrumentation will often help in the first reduction.

It is our opinion that most fragments should be left in place. This applies to those with periosteal or soft tissue attachment or even without such attachment. Bone is produced not only from the periosteum but from the endosteum as well, and most fragments contain either one or the other element. If the fragments are closely approximated and properly splinted and not disturbed after the first few days, a blood clot soon surrounds them and union ultimately occurs. Time

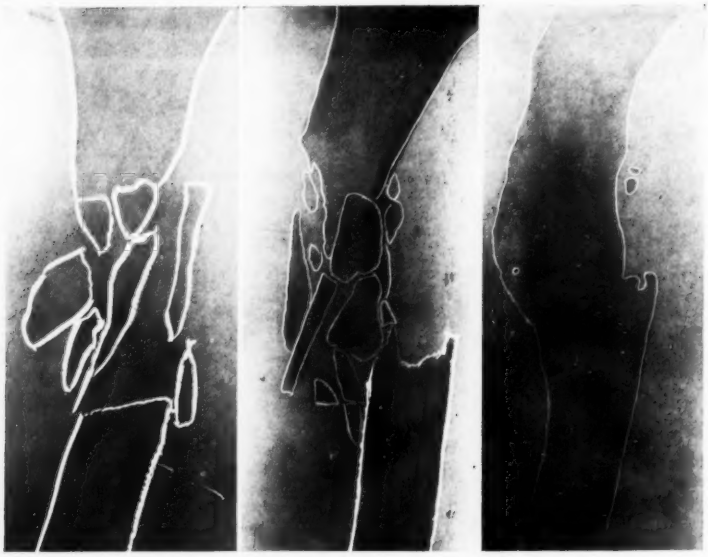

Fig. 2. M. L. Compound comminuted fracture of the femur. Before and after union.

and again, we have seen shafts so comminuted that a 3 or 4 inch hiatus would be present if all loose fragments had been removed. In such a case, we prefer to take chances with the fragments rather than with an autogenous bone graft. If a third or a half of the thickness of the shaft remains in line, one may be justified in removing whatever fragments are loose and unattached in the wound. Or, in case it is impossible to push a fragment down into a muscle bed, it may be removed.

The triangular shaped fragment comprising more than half of the thickness of the shaft will almost always grow if forced back into its normal position.

A fragment, consisting of the entire section of the shaft of a long bone, presents a serious problem when detached at both ends. Suturing such a piece from the radius, ulna, or fibula, rarely succeeds, but if it is done and does not live *in toto*, it acts as an autogenous bone graft and serves the purpose of bridge work for new bone formation.

In case the fragments cannot be molded by the hands, it is then proper to do more radical open work. The fracture is widely exposed, and if the fragments cannot be interlocked and held in position, we fasten them in place by whatever method is most applicable to the individual case. We believe that one is not justified in putting in an autogenous bone graft as a method of internal fixation in a fresh fracture in a healthy individual. We feel this is adding an unnecessary insult to the original injury.

Neither do we believe that a surgeon should unhesitatingly and without exception condemn the use of metals of various kinds. Many a time we have been pleased to have at our disposal steel plates, nails, screws, and different sizes of wire. We have seen more than one case, impossible to hold in proper alignment, heal perfectly with internal metal fixation. The necessity of removing the metal at a later date is of little consequence. In our experience, we have seen but two cases of fibrous union following steel plate application, a small number compared with the total number of delayed or non-union cases in which no internal fixation of any kind was used.

Since adopting the experimental work of Zierold of Minneapolis, given us in a personal communication several years ago, and using only copper plates, screws or copper wire for internal fixation, we feel that our end-results have been greatly improved, not only in those cases requiring internal fixation but in non-union cases as well.

We are adherents of complete immobilization for such injuries; we are not over-zealous in the use of irrigating fluids in infected fractures and look askance on the wet, soaked bed so common

Fig. 3. F. G. Compound comminuted fracture of upper third of leg. Immediately after injury and after union.

with most of us when the Dakin technique is used. We believe in heat and massage but have never recovered from our war time disappointment in the use of all types of electrotherapy.

Of course, we have seen an occasional sinus with a sequestrum at the bottom, which should be removed, but we have never seen a case which did not ultimately heal after the dead bone had been removed and bismuth paste instilled. Even though a sinus is present, the injured man is not necessarily kept from working.

Considerable research has been done by investigators both in this country and in Europe relative to bone formation, the latest of which is by Rohde of Freiberg (1). As his conclusions based on animal experimentation bear out our clinical work we desire to discuss his paper briefly.

The periosteum is composed of two layers, the outer or adventitia, which is connective tissue throughout and which contains no osteoblasts, and the inner or cambium, which is very thin and holds the osteoblasts. The entire periosteum receives its blood supply through the soft tissues with which it is intimately associated and the blood passes through the outer layer into the cambium cells. There is no blood supply or at least none of consequence from the inside to this tissue.

During childhood, there is no line of demarcation between the two layers of the periosteum, but in adult life, if the periosteum is stripped from the bone by blunt dissection, the cambium layer does not come with it but remains attached to the cortex.

The endosteum, which is a thin membrane separating the medulla from the cortex contains osteoblasts and receives its blood supply entirely from the nutrient artery of the bone and its branches, and none from the outside whatever.

In order to stimulate normal adult periosteum and endosteum to form bone, three factors are essential: first, a trauma; second, active hyperæmia; and third, tissue destruction which acts as an agent to continue hyperæmia until bony union is complete. If these contentions are true, as based on many animal experimentations, then can one see that adult bone fragments containing cortex also hold the cambium layer with its osteoblasts and therefore, are potential bone forming elements which should never be discarded.

If tissue destruction is necessary to produce a hormone, or agent of any type which continues active hyperæmia, then it is wrong to cut out all questionable tissue which may produce this hyperæmia.

Mechanical irritation, as by continuous and early active motion of the fragments, causes injury to the endosteum which results, not in bone formation but a proliferation of non-specific connective tissue between the fragments and a resulting pseudo-arthrosis. Hence, both those who advocate no splinting of fractures and those who

practise very early active and passive motion are in danger of forming a greater number of delayed or non-unions than would occur were the teachings of Rohde carried out.

Attention is also called to the recent work of Robison (2) of England who believes that bone and ossifying cartilage produce an enzyme which has the property of converting the highly organized hexose monophosphate esters present in the blood cells into an inorganic phosphorus which is deposited in the bones. He believes that this enzyme is secreted from that portion of the bone adjacent to the bone forming layers. Hence, if fragments with their attached cambium cells are taken out, the secretion of this enzyme must be materially lessened and the chances for non-union increased rather than diminished.

Of all the perplexing questions to answer, the one relative to lost time is the most difficult. A number of years ago, the author (3) worked out a schedule to show the earliest time at which patients could return to work after all types of fractured legs. Recently (4) the series was augmented and comparative sheets issued. In the last series of cases the patient returned to work more quickly and the entire credit was given to the newer methods used. Whether this should be the case is questionable. We have all shortened the time of disability, have taken off splints at an earlier date than formerly, and have discharged patients much more quickly than we did years ago. Analogous to this is the change in handling abdominal surgery. How many of us have forgotten the starvation period prior to all elective abdominal surgery and who would have dared 25 years ago to have allowed a patient upon whom a laparotomy had been done out of the bed at the end of the first week?

So it is with fractures. The author does not wish for a minute to belittle the excellent work of the war surgeons during those trying times but desires merely to call attention to the fact that fractures and their complications in war time are quite different from those in civil life and should be treated by distinctly different methods.

The author desires to express his thanks to Drs. Donald Macrae of Council Bluffs and Kellogg Speed of Chicago, for information on débridement as used by them during the late war.

REFERENCES

1. Rohde. Surg., Gynec. & Obst., 1925, Dec.
2. Robison. Biochem. J., 1923, xvii, 286; 1924, xviii, 740.
3. Clough, J. Lancet, 1916, Sept.
4. Idem. Internat. J. Surg., 1924, Aug.

INTENTIONAL FRACTURE OF THE HUMERUS IN THE NEWBORN

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THE title, "Intentional Fracture of the Humerus in the Newborn," might at first suggest either surgical boldness or a craving to present the unique to a medical audience, or both. If such be the apparent inference, the situation should nevertheless be tempered by the fact that the writer has, after a reasonable search of the literature, failed to find any definite report of cases. That men have intentionally fractured the humerus in the newborn in order to save the child or the mother or both, there is probably no doubt at all. Everyone is able to recall instances in which, during the process of a difficult labor, the humerus or the clavicle or the femur has been fractured. Whether such instances were intentional or not may be unknown but my own impression, until the last few years, has been that these fractures were accidental. It has seemed to me that their occurrence was usually followed by a certain amount of remorse on the part of the attending obstetrician and sometimes an effort to justify what was apparently an accident.

Our position today is that a fracture of the femur is probably never excusable, even as an accident. We feel that a fracture of the collar bone is often excusable as an accident, and we may soon be willing to say that breaking it intentionally is justified. There is at the present time no recognized technique for such procedure, which would seem to make it safe even in skilled hands and, without this, the operation might easily run the risk of being classified as bad surgery. With reference to the humerus, however, we take the stand that its accidental fracture is at least excusable on a par with that of the clavicle and that its intentional fracture is, in exceptional cases, thoroughly justified when, in the opinion of the obstetrician, either the mother or the child is in danger. It is superfluous to add that any fracture, either accidental or intentional, in experienced hands, is never to be condoned except in cases in which justifying abnormalities, such as are accepted by critical obstetrical practice, are shown to exist.

As a contribution to the subject I am taking the liberty of presenting five cases of intentional fracture of the humerus which have been referred to me as such for treatment, during the last 5 years, at the Evanston Hospital where, in the maternity department there have been 3,600 deliveries with an infant mortality of 3 per cent and a maternal mortality of 29/100 per cent. Four of these cases were referred by Dr. W. C. Danforth and one by Dr. P. F. Schneider.

LITERATURE

C. H. Holzhausen, in 1899, reports a fracture of the surgical neck of the humerus in a child brought to the clinic because the arm hung limp. The child was born normally without either doctor or midwife. Union resulted in about 3 weeks with ultimate good function.

Truesdale's book, *Birth Fractures and Epiphyseal Dislocations*, published in 1917, derives its material almost exclusively from the New York Lying-In Hospital during a period of 6 years. The humerus was the most frequently broken bone during delivery. Incidental to 33,000 deliveries there were 39 fractures of the humerus in 37 infants. Twenty-four of these were produced during breech extraction, 7 were attributed to difficulty with the arms at the pelvic outlet in vertex presentations and in the balance no cause was determined. The site of the fractures was always at or near the middle of the shaft, were transverse, complete, never green-stick, and overriding was unusual. In every case, Truesdale states, there was some evidence of radial nerve paralysis as shown by wrist drop immediately following delivery, which cleared up in all cases in a few weeks. Among a half dozen common causes of dangling arm in the newborn, he thinks syphilis is one as shown by specific periostitis in the X-ray. No splint of any sort is used in the treatment. The fractured arm is merely immobilized against the chest by adhesive carried about the body with a small pad in the axilla, and the forearm bandaged in flexion and directed toward shoulder of the uninjured side. Callus formation was demonstrated in 8 or 12 days. No instance of non-union was reported under this method.

W. Rubsamen, in 1918, without reporting any cases, advocates a method of immobilization and treatment of humerus fracture with the arm held for 3½ weeks in a suitable position by aluminum triangles placed at the axilla, elbow, and on the thorax. The elbow apparently was held in partial extension.

Stromeyer, in 1918, criticised Rubsamen's method with the contention that the elbow

should be held at a right angle and the arm should extend directly from the body.

L. Von Lesser, in 1918, in an article entitled, "Treatment of Fracture of the Humerus in the Newborn," reports a case of right shoulder presentation followed by version in a strong labor lasting 4 days. There was mal-union at 6 weeks when the humerus was refractured and the arm placed in supination at right angles to the thorax in a splint from the fingers to the shoulder extending over the bed with a weight of not more than 500 grammes attached to it. His claim for such a splint was that the movements of the child or its care is not interfered with. His end-results 3½ years later showed both arms to be equal in length and, while the outward raising of the injured arm was somewhat limited, it seemed to have more muscle strength than the opposite arm.

G. L. McWhorter, in 1920, reported a fracture of the humerus in a rapid, forcible breech extraction with the arms over the head. There was no evidence of paralysis but the malposition of the fragments was corrected under the fluoroscope. The humerus was extended laterally to the body on a board splint placed across the back of the chest. At the elbow another board splint extended upward for the forearm to rest upon. An X-ray after completing the dressing showed improvement but not satisfactory position. A successful realignment was then accomplished under the fluoroscope and a molded plaster reinforced splint folded along the chest, under the axilla and down the arm to the fingers maintaining the arm in that degree of abduction and the elbow in such acute flexion on the chest as the fluoroscope demonstrated to be proper. The splint was removed in 3 weeks. Alignment and function was satisfactory.

H. L. Rocher, in 1922, presented a new apparatus for the treatment of obstetrical fractures of the humerus. It was similar in principle to his femur fracture splint designed some time previously. The baby is placed on a padded board, serving as a mattress, a little longer and wider than its body. On one side of the board, at shoulder height, is a prop inclined at 140 degrees on the horizontal plane of the board, in such a way as to make possible immobilization and extension of the fractured arm with adhesive and rubber bands. Small longitudinal splints of card board, applied to the arm, as may be needed, are used to fortify the dressing. Rocher mentions a case brought in by a midwife in which this apparatus made it possible for the child to be carried about and to be breast fed without removal from the board.

John T. Williams, in 1923, reports 7 cases of injury to the newborn due to difficulty in delivering the shoulders. In one of these the humerus was accidentally fractured. The mother was a X-para, the first seven labors being normal and the eighth and ninth being operative. The ninth baby weighed 12½ pounds. In the case of the tenth baby an attempt to deliver the shoulders by Kristeller's maneuver failed, and the humerus of the posterior arm was fractured. The baby weighed 13 pounds, 3 ounces.

Ehrenfest, in 1923, states that the humerus is often injured in breech presentation, if it is necessary to bring the arm down directly from behind the nape of the neck and if it is impossible to push back the body of the infant a little so that the arm may be carefully wiped downward over the face by passing the introduced hand gently from the shoulder over the elbow down to the baby's wrist. He further states that the obstetrician will be justified in deliberately breaking the humerus or the clavicle in this procedure if in his best judgment a quick delivery is required in the best interests of the baby. In an earlier paper by the same author in 1922, entitled "Better Obstetrics and the Problem of Birth Injuries of Newborn Infants," it is interesting to note that the only fracture mentioned is that of the clavicle.

W. F. O'Donnell, in 1924, discussing "Injuries and Accidents in the Newly Born," states that fracture of the upper end of the humerus and separation of the upper epiphysis constitutes the most frequent site of injury to that bone in breech extractions especially when the arms are found in extension. His treatment includes a plaster cast.

J. B. De Lee, in the fourth edition of his *Principles and Practice of Obstetrics*, published in 1924, states: "Fracture of the humerus results from direct trauma in delivering the arm. I have twice deliberately broken this bone to save the child and succeeded."

REPORT OF CASES

Case 1. M, July 4, 1921. Weight 7 pounds, 2 ounces. Mother is age 32. Breech extraction was performed. The left arm was delivered successfully by Kristeller's maneuver but it was impossible to deliver the right arm by the same method. In order to avoid further delay and in the interest of the baby which was apparently in danger, the right humerus was fractured at the middle of its shaft as seen in Figure 1. You will observe that this is a diagonal fracture with marked overriding in contrast to the others in this series, most of which are transverse. The best alignment that was possible to obtain is shown in Figure 2, taken the following day. Rubber band extension, made possible with application of a Thomas ring splint, apparently corrected the overriding although no film was taken

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. Case 1. Fracture of right humerus.
Fig. 2. Case 1. Alignment on day after operation, elastic extension shown.
Fig. 3. Case 1. Result 4 years, 6 months after fracture.

to demonstrate the further correction. The final result in this case, however, is revealed in Figure 3, taken January 20, 1926, 4½ years later. There was no paralysis in this case.

Case 2. W, December 18, 1922. Weight, 4¾ pounds. The mother was age 26, I-para. A few days before term she exhibited an altered blood chemistry, blood pressure 180, headache, spots before her eyes, œdema of face and extremities, albumin, casts, pus and bacteria in the urine, and eclamptic convulsions before and after delivery. Manual dilatation[1] and internal version with breech extraction was performed. A transverse fracture of the left humerus at the middle of the shaft was deliberately produced and referred to me for care. Figure 4 shows the fragments in fair approximation with no overriding but with slight outward angulation. Because of the fair position and the weakened condition of the baby, which was probably premature and therefore under weight, the arm was simply bandaged to the chest with the elbow flexed and held directed toward the uninjured shoulder for 9 days. At this time (Fig. 5) no overriding was shown but a slight mal-alignment with a fairly well developed callus. The soft callus permitted a manual correction under the fluoroscope. The arm was again bandaged to the chest in the previous position supported by anterior and posterior cardboard splints with satisfactory results and normal function. Figure 6 taken nearly 2½ years later shows the satisfactory end-result in the case. I am advised by the father that it is impossible to distinguish between the function and contour of the injured and uninjured arms at the present time. There was no paralysis in this case.

Case 3. F, October 30, 1924. Weight, 8 pounds 6¾ ounces. The mother was age 31, II-para. She was in the second stage of labor for 2½ hours with a right occipito-

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 4. Case 2. Position of fragments was good and as infant was in weakened condition arm was simply bandaged to chest for 9 days.
Fig. 5. Case 2. Condition at end of 9 days.
Fig. 6. Case 2. Picture taken 2½ years later.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. Case 3. Condition at time infant was referred for treatment.
Fig. 8. Case 3. Two months after injury. Note good callus formation.
Fig. 9. Case 3. Six months after injury. No shortening demonstrated.

posterior presentation that could not be delivered as such. Version was performed with breech extraction. The left hand was held immovable behind the nape of the neck. In the interests of the baby, rapid delivery of the aftercoming head was imperative and the left humerus was fractured manually in order to facilitate this operation. Figure 7 was taken at the time the case was referred to me for care. It shows a transverse fracture of the shaft of the left humerus immediately below its middle. The arm was supported in slight abduction with the elbow at right angle flexion in a tin splint made to measure which had a base encircling about half of the chest. Figure 8, taken nearly 2 months after the injury, shows a well developed callus with the humerus in a definite outward angulation and with a slight shortening. Figure 9, taken 6 months after injury, shows a satisfactory end-result with absorption of the callus and no shortening capable of being demonstrated. There was no paralysis in this case.

Case 4. V, October 30, 1924. Weight 12 pounds, 5 ounces. The mother was 38 years old, IX-para, and

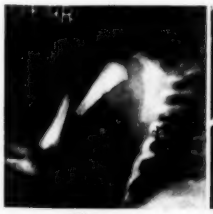

Fig. 10.

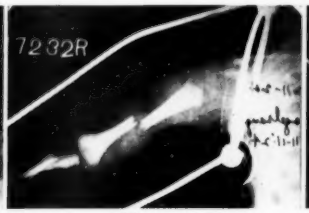

Fig. 11.

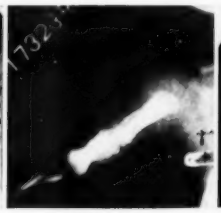

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 10. Case 4. Condition 5 days after birth.
Fig. 11. Case 4; 2 weeks after birth.
Fig. 12. Case 4; 13 days after reduction of fracture.
Fig. 13. Case 4. 1 week after removal of splint.
Fig. 14. Case 4. The end-result, 6 months after the injury.

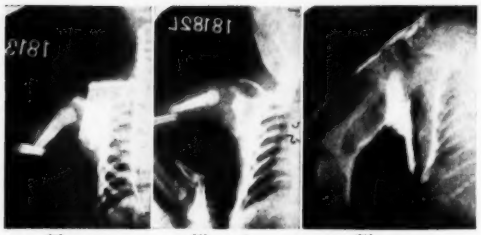

Fig. 15. Fig. 16. Fig. 17.

Fig. 15. Case 5. Marked internal angulation of humerus and overriding of fragments.

Fig. 16. Case 5; a week after reduction of fracture.

Fig. 17. Case 5; 2 weeks after delivery.

weighed 240 pounds. She showed a four plus Wassermann at the ninth month of pregnancy and was given a crowded specific course of treatment during that month and for 3 weeks thereafter, which latter was regarded as an overdue period. Her history showed that the fourth, fifth, sixth, and seventh babies were stillbirths. The eighth lived for 3 months only. She had a very hard and difficult labor with a transverse arrest of the shoulders, which necessitated version and breech extraction. It was found impossible to deliver the right arm which was wedged behind the occiput. The right humerus was, therefore, fractured at the middle of its shaft to facilitate the safe delivery of the child. Because of the desperate condition of the child, it was watched carefully for several days until its condition made an X-ray wise and possible. Up to this time the child was limp in all its muscles but, after several days' watching, function had returned everywhere except in the right arm, forearm, and hand, which was found to be paralyzed. Figure 10, taken 5 days after birth, shows a transverse fracture of the right humerus at the middle of shaft with marked displacement and overriding. Reduction was made and the arm was placed in a Thomas ring splint with rubber band extension and with a pad elevating the lower end of the upper fragment as shown in Figure 11, taken nearly 2 weeks after delivery. It is interesting to note in Figure 12, taken 13 days after reduction, the extensive callus formation with periosteal stripping which extends a great distance above and below on each fragment. At this time the splint was removed to facilitate better nursing care of the baby which had suddenly developed a temperature of 104 degrees and which reached 107.6 degrees one week later, with the urine showing albumin, casts and sugar. At this time a spinal Wassermann was negative. Following the removal of the splint the baby was able to raise the right arm and normal use returned in a few days thereafter. Figure 13, taken 1 week after removal, shows the fairly good alignment under the circumstances and the beginning of absorption of the extensive callus. The end-result in this case is shown in Figure 14, taken 6 months after injury. There is a trivial amount of shortening but the alignment is excellent and the result is considered satisfactory. It is interesting to note that an X-ray taken of the *left* or uninjured arm and forearm 5 weeks after delivery was reported by our roentgenologist as showing no bone pathology present, but a little over 3 weeks later there developed a sudden brachial palsy in this left arm which up to that time had shown no birth injury. The explanation of the left arm paralysis should probably rest with the neurologists, but the difficulty we had with the prolonged treatment of this latter condition might suggest a late result from brachial plexus pressure at the time of delivery. The fact remains that in this particular case the arm which was deliberately fractured in order to facilitate rapid delivery made a satisfactory recovery whereas the opposite arm, also difficult to deliver, did not. Examination of the child on August 11, 1925, shows that the function of the right arm is normal but that while the left hand can be lifted to the mouth, all movements of the arm are somewhat restricted.

Case 5. B, March 29, 1925. Weight 7 pounds, 6¾ ounces. The mother was age 41. She came to term in toxæmia and had neglected her own care during the latter months of pregnancy in spite of the advice of her attending obstetrician. Version with breech extraction was performed. Both feet presented with a prolapsed cord and the aftercoming head was rotated to an occipitoposterior position. The right arm was held over the face and the left was caught behind the occiput. In order to hasten delivery, in the interest of both mother and child, the left humerus was fractured about the middle of the shaft. Marked cyanosis was present for 24 hours after delivery, and there was a left sided convulsion lasting several hours with a temperature as high as 105 degrees. The baby had numerous general convulsions and the spinal fluid was found to be bloody. In this case the placental blood and blood from the father were both negative to the Wassermann test. There was present in this case a paralysis of the left arm with marked wrist drop. Figure 15 shows the marked internal angulation of the humerus with overriding of the fragments. Because of the poor general condition of the baby, temporary bandaging to the chest wall was done and a week later reduction performed. Figure 16, taken a week later, shows some improvement in position but overriding still present. The fragments were then realigned and the arm maintained in a plaster abduction splint with the elbow at right angle flexion and the wrist dorsiflexed. The plaster was carried entirely about the chest for general support. The position of the humerus and the plaster dressing is shown in Figure 17, which was taken a little over 2 weeks after delivery. Over the telephone, every possible effort was made recently to induce the mother to bring the baby for an X-ray in order to show end-results. All I am able to report is the opinion of Dr. Aldrich, the attending pediatrician, that function has completely returned and that the left arm seems to be normal like the right. The mother also testifies to the baby's normal function but is prevented by certain religious convictions from submitting to a final X-ray.

TREATMENT

The supinated extension splint of von Lesser, the padded board extension splint of Rocher and Rubsamen's aluminum triangles for arm abduction and elbow flexion all appeal as possessing certain advantages. It is certainly important that a newborn baby shall be immobilized in such a way as to make breast feeding possible. In the hands of their particular advocates the splints mentioned have no doubt served very well, but our feeling, even in connection with this small series of five cases, is that as simplified a dressing as is consistent with thorough treatment should be adopted. We feel that the primary dressing of the fractured humerus in the newborn must take into consideration the fact that usually we are dealing with a baby in exhaustion follow-

ing a difficult labor. It may be unwise for several days to subject the infant to more than simple card board splints applied merely to the arm. In all probability we should avoid removal to and manipulation under the fluoroscope, as well as encircling the chest with any fixation apparatus immediately after delivery in the case of an exhausted infant. As soon as reaction has taken place, however, our inclination is to favor the so-called neutral muscle position of the arm, forearm and hand. Such degree of arm abduction and elbow flexion should be selected as may favor proper alignment of the fragments together with such dorsiflexion of the wrist as will markedly overcorrect any wrist drop that may be observed. To this end we advise the carefully made plaster dressing similar to that shown in Figure 17 of Case 5.

The chest is completely included in a well padded jacket from the waist line to the axillæ which is then continued as a part of the shoulder, arm, forearm, and hand plaster casing of the injured side. In order that the arm, forearm, and hand may be observed frequently, the upper half of the latter portion of the splint from the shoulder to the tips of the fingers is made removable. This plaster cast is perhaps a little difficult to make but it would seem to cover all the requirements of treatment in the average case including comfort to the baby and successful breast feeding. There is no doubt that under careful watching, Truesdale's method of invariably strapping the arm to the chest may be successful in many instances but such a position would seem to deprive the patient of the value of abduction, so very important to the recovery of an injured brachial plexus, as well as adequate treatment in oblique and overriding fractures. We feel that complete right angle abduction of the arm and particularly any overhead extension of the arm at all in these cases may be criticised in certain instances as adding a possible insult to an already injured brachial plexus which should have the advantage of more moderate abduction. Unlike Truesdale's series of cases ours were not all transverse. The tendency of a fracture at or near the middle of the shaft of the humerus in the newborn is toward an outward angulation. It is, therefore, important in all cases, no matter what fixation apparatus is employed, to observe and correct any such tendency during the first week or 10 days, while the callus is still soft and capable of being bent. Finally it may be said that, commendable as it may be to secure proper alignment of fragments, a perfect anatomical reduction is of little value if the position selected is maintained longer than the period of complete callus formation (usually about 3 weeks) or is maintained without respect to future circulation, abnormal muscle contraction, or proper relaxation of a lacerated brachial plexus. Our thought in this connection from the experience we have had would suggest that the intentional fracture of the humerus, following as closely as possible the technique outlined below, produces infinitely less injury to the brachial plexus and other soft parts than the more prolonged hooking of the finger in the axilla or about the arm during an effort to deliver.

TECHNIQUE

The production of the intentional fracture of the humerus at or near the middle of the shaft should carry with it the extreme caution of avoiding all unnecessary injury to the brachial plexus or the soft parts. The finger of the obstetrician should be hooked about the arm at or about its middle, selecting if possible the external outer aspect for the application of rapid, firm, and positive pressure until the bone is felt to yield. It would seem from our series that a rapid fracture of the bone would produce much less brachial injury than any prolonged pressure, even though the arm is delivered without a break. This we think applies to the application of pressure even at the inner aspect of the arm where, of course, the brachial plexus is open to more direct injury.

REFERENCES

BRUM-BOURGUET, A. J. E. Contribution à l'etude des fractures du condyle externe de l'humerus chez l'enfant; leur consolidation vicieuse; traitement de cette complication par l'ostéotomie linéaire. Bordeaux, 1892.

BURROWS, H. Congenital dislocation of right humerus. Proc. Roy. Soc. Med., Lond., 1913, vii, Sect. Stud. Dis. Child., 178.

COUDRAY, P. A propos d'une fracture de l'extrémite inférieure de l'humérus chez un jeune enfant. J. D. conn. méd. prat., Par., 1898, 100.

DE LEE, JOSEPH B. Principles and Practice of Obstetrics. 4th ed. Philadelphia: W. B. Saunders Co., 1924.

Idem. Better obstetrics and problems of birth injuries of newborn infants. Am. J. Obst. & Gynec., St. Louis, 1922, lv, 61-66.

EHRENFEST, H. Prevention of birth injuries of child. Illinois M. J., 1923, xliv, 20–27.

GANGOLPHE. Fracture obstétricale de l'humérus; paralysie radiale; libération du nerf le 38 ème jour; guérison. Bull. Soc. de chir. de Lyon, 1897–8, 27-30.

GERBER, B. Foklartores esete egynapos csecsemongel. Gyogyaszat, Budapest, 1893, xxxv, 111; also trans. (abs) Pest. med.-chir., Presse, Budapest, 1893, xxix, 341.

HANNAH. Injuries to new born at birth. Texas St. J. M., Fort Worth, 1916, xi, 539.

HOLZHAUSEN, C. H. Fracture of the arm in a newborn child. Med. Rec., N. Y., 1899, lvi, 715.

JENKINS, J. O. Birth injuries to newborn. Kentucky M. J., 1924, xxii, 566-567.

KUSTNER, H. Injury of the child by anesthesia of the mother in labor. Deutsche med. Wchnschr., 1924, i, 1112-1113.

LARTET, L. Fractures de l'extrémite inférieure de l'humérus chez les enfants; traitement par l'extension et la supination combinées à la flexion. Paris, 1899.

VON LESSER, L. Zur Behandlung der Humerusfraktur der Neugeborenen. Muenchen. med. Wchnschr., 1918, lxv, 1440.

LOVIOT. Paralysie fasciculaire du membre supérieur droit chez un nouveau-né, consécutivement à une fracture humérale produite pendant l'accouchement. Bull. et mem. Soc. obst. et gynec. de Par., 1895, 121-125.

MCWHORTER, G. L. Birth fracture of humerus reset with aid of fluoroscope. Surg. Clin., Chicago, 1920, iv, 1155.

O'DONNELL, W. F. Injuries and accidents in newly born. Internat. Clin., 1924, i, 48-53.

ROCHER, H. L. Appareillage special pour fracture obstétricale de l'humérus. Bull. et mém. Soc. de méd. et chir. de Bordeaux, (1922), 1923, 17-19.

RUBSAMEN, W. Zur Behandlung der Humerusfraktur der Neugeborenen. Muenchen. med. Wchnschr., 1918, lxv, 353.

STERN, A., and SCHWARTZ, P. Clinical aspects of birth injuries. Klin. Wchnschr., 1924, iii, 931-934.

STROMEYER, K. Zur Behandlung der Humerusfraktur der Neugeborenen. Muenchen. med. Wchnschr., 1918, lxv, 513.

WILLIAMS, JOHN T. Dystocia of the shoulders in head presentation. Boston M. & S. J., clxxxix, 465-467.

OPERATIVE REMOVAL OF OSTEOMA OF LOWER EXTREMITY OF TIBIA

BY GUY A. CALDWELL, B.S., M.D., F.A.C.S., SHREVEPORT, LOUISIANA

IN a case of non-malignant tumor of the lateral aspect of the lower extremity of the tibia, immediately above the ankle joint and directly between the tibia and fibula, the problem of removing the tumor presented some difficulties. To maintain good function in the ankle, it was essential that the joint should not be invaded and that the continuity of the fibula should be preserved. On the other hand, the close approximation of the two bones in their lower extremities and their relation to the important vessels and nerves made an anterior or posterior approach impossible. A lateral approach, by doing an osteotomy of the fibula above the tumor and turning the lower fragment outward, seemed to be the most logical procedure. The case described was operated on one year ago by this route. The result is a good weight-bearing ankle without pain or deformity and with a complete range of motion in all directions.

RÉSUMÉ OF CASE HISTORY

A. M., white, female, age 18 years, was admitted April 5, 1924. The patient had had pain and swelling behind the left ankle for 18 months or 2 years. She did not remember an injury of any kind. However, swelling and tenderness usually developed behind the left malleolus after vigorous exercise, and for the past 6 months swelling had been persistent and discomfort had been sufficient to limit her activities seriously and to keep her awake at night. No loss of weight or strength and no fever had been noted. Her general health had always been excellent.

The patient was well developed and nourished, and walked with a slight limp, protecting the left ankle. The foot and leg appeared normal except for swelling behind the external malleolus. There was no atrophy or weakness of the muscles. The arches and weight-bearing lines were good. There was no visible swelling on the front of the ankle or leg. Posteriorly, there was fusiform enlargement immediately behind and partially including the external malleolus. There was no redness or heat, and no limitation of motion in any of the joints, but she complained of "soreness" on extending or abducting the foot against resistance. On palpation considerable thickening of a doughy consistency was present over the peroneii tendons. Tenderness was marked over the tendons, but not on percussion directly over the tibia and fibula. However, the pain was quite marked when the external and internal malleolus were pressed together or when they were separated by forcible eversion of the foot.

The Wassermann examination was negative. The hæmoglobin, and the red, white, and differential blood counts were within normal limits. Urinalysis was negative.

The X-ray examination showed a spherical enlargement outward from the lower portion of the tibia, with very little change in the bone structure at that point. The enlargement was evidently an outgrowth from the tibia, with some destruction of the adjacent surface of the fibula as the result of pressure. There appeared to be no invasion of the fibula and no destruction of the tibia.

A provisional diagnosis was made of osteoma of the lower extremity of the tibia with erosion of the fibula by pressure.

Progress and treatment. The ankle was put at rest in plaster and the patient directed to use crutches for 2 weeks. At the end of this time the swelling was much diminished over the peroneii tendons and all of the joint movements were free, but the tenderness had increased. X-ray examination at this time showed no appreciable change. The history and roentgenograms were sent to Dr. J. C. Bloodgood in Baltimore, Maryland, for opinion. He replied: "You have there nothing but new bone formation, and the destruction of bone in the fibula is from pressure. You will observe that bone formation is taking place in the rim left of the fibula. From this X-ray, if there is no disability, I would advise against any operation."

The patient continued on crutches, with ankle bandaged, for 2 weeks longer, but the pain increased, became more constant, kept her awake at night, and made weight bearing intolerable. Operation was deemed necessary for

Fig. 1.

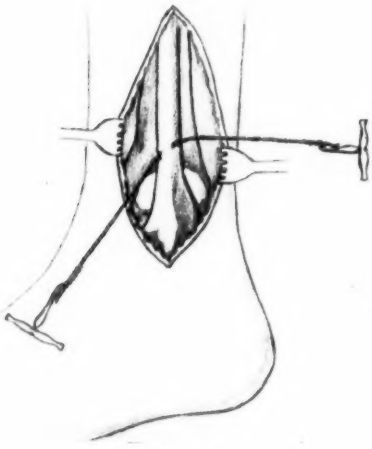

Fig. 2.

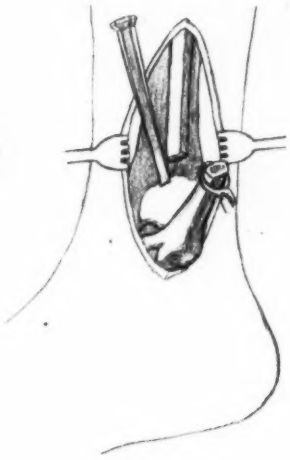

Fig. 3.

Fig. 1. Drawing made from X-ray pictures showing the osteoma in close proximity to the ankle joint, projecting from the lateral aspect of the tibia, and eroding the fibula.

Fig. 2. The lateral incision with oblique osteotomy of the tibia.

Fig. 3. Retraction of lower fragment exposing the base of the tumor.

relief of the pain and disability which were gradually increasing even under rest.

Operation. Removal of osteoma, June 3, 1924. A 6-inch incision extended from the tip of the external malleolus up along the fibula.

Pathology. The fibula, although eroded by the tumor and somewhat adherent to it, had not been invaded by the tumor, there being a clear line of demarcation. When the fibula had been pried away, a thin layer of gelatinous material appeared which seemed to be coating the inner surface of the cavity. There was no bony attachment to the tumor. The tumor was about 3.5 centimeters in diameter and was evidently an outgrowth from the outer surface of the lower extremity of the tibia, being immediately above the cartilage of the ankle joint. The surface of the tumor, externally, was rough and consisted apparently of cancellous bone with no areas of cartilage visible. The margins were covered with the periosteum and the base of the tumor flared outward at its junction with the tibia.

Procedure. The fibula was exposed in the lower third. The muscles in front and behind were separate and retracted. A gigli saw was passed between the tibia and fibula about 1 inch above the tumor, and the fibula was divided. The lower fragment was then pried loose from the surface of the tumor and retracted outward, exposing the tumor and outer surface of the tibia. The margins of the tumor were defined, and its base excavated with gouge and chisel. The fibula was then replaced and tied with kangaroo tendon passed through drill holes. Plaster bandage was applied from the toes to the knee.

Progress. The wound healed without infection, and convalescence was uneventful. Plaster was divided after 4 weeks, the wound dressed, and light massage and active motion instituted. The patient began light weight bearing after 6 weeks. By September 15, 1924, 3 months after the operation, the patient was walking without discomfort or limp, and was able to play tennis and dance without pain.

Remarks by Dr. J. C. Bloodgood. Judging from the roentgenogram made before operation, I think we may be quite sure that we are dealing with a benign bone formation. We can see that there is a bulging of the tibia against the lower shaft of the fibula above the epiphyseal line. It gives the impression of a congenital condition. The cortical line is lost and the surface of this bulging dome shaped area of the tibia shows evidence of new bone formation. Corresponding to the projection of the tibia against the fibula is a defect in the fibula but the surface in the concavity defect is also covered with new bone

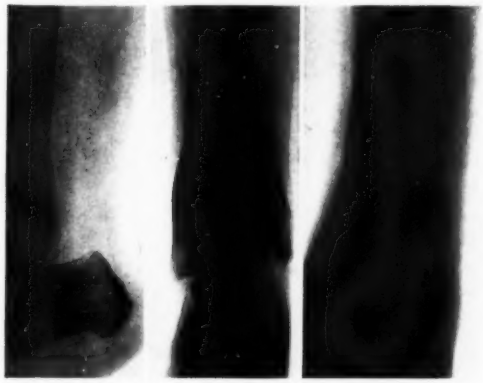

Fig. 4. Fig. 5.

Fig. 4. Roentgenograms taken before operation, anteroposterior and lateral views.

Fig. 5. Roentgenogram, anteroposterior view, after operation.

Fig. 6. Photographs of left ankle showing the range of motion at the end of 3 months after operation.

formation. So here, the pressure of the bony growth of the tibia has produced a formation of new bone on its surface and while the fibula is being absorbed by pressure, the remaining bone surface is throwing out new bone formation.

In my opinion we are dealing with a congenital condition which on account of some static influence has begun to grow.

The gross specimen and sections from the tumor removed show cancellous bone with normal fat. There is no evidence of new bone formation toward the center of the tibia, but as we come toward the surface, the marrow fat between the bone islands is replaced by dense eosin staining fibrous tissue. On top of this is a good zone of new bone formation denser than cancellous bone; and on top of this, cartilage. A bony growth with cartilage on this surface suggests a congenital condition, yet there is nothing in the roentgenogram to make one suspicious of any cartilage in this new growth. This is the third case of this type of osteoma in this position. The operator here should be congratulated on his original scheme to resect the fibula and then replace it.

How important it is to have the X-ray after operation! Because if we did not know about the pre-operative roentgenogram and the operation; and if we did not see the evidence of fracture of the fibula, the postoperative roentgenogram might be interpreted as a malignant new-growth.

RESULT

The patient was seen at the end of 6 months, again at the end of 1 year, and finally after 18 months. She had a complete range of motion in the ankle and foot without pain, and with no discomfort after vigorous exercise.

It would seem, therefore, that this approach is safe and meets the indications for removal of a non-malignant tumor in this location.

AN UNUSUAL RECTAL POLYP: ANTERIOR SACRAL MENINGOCELE[1]

By ROGER L. J. KENNEDY, M.D., Rochester, Minnesota
Section on Pediatrics, Mayo Clinic

NEITHER rectal polyp nor anterior sacral meningocele occurs often in children, and in a search of the literature no reports of a combination of the two conditions was found.

The following is the report of a case of the latter condition observed in the Mayo Clinic. The patient, a female child, aged 22 months, was brought for examination because of a mass protruding from the rectum. At 2 weeks of age the child had had a spell in which she lay "like dead" for 24 hours. There had been no other past illnesses. The mass which had been present since birth had bled at times. Defæcation had been very painful, and frequent laxatives had been given.

The child was obese. There were moderate rachitic manifestations, a marked outward bowing of the femora, tibiæ and fibulæ. A red pedunculated tumor, apparently arising from the region of the coccyx, covered the anus and part of the vulva (Fig. 1). It was difficult to ascertain the boundary and limits of the pedicle. A proctoscopic examination could not be made because of the obstruction offered by the tumor, but a note was made at that examination to the effect that a polypoid mass protruded from the anus, was attached posteriorly and seemed to arise from the coccygeal periosteum. There was a fæcal fistula on the left wall of the vagina just above the labium minus. The roentgenogram showed congenital deformity of the sacrum and spina bifida occulta of the fifth lumbar segment. Examination of the blood and urine was negative. The pre-operative diagnosis was polypoid growth, probably arising from the sacrum or pelvis and involving the rectovaginal septum.

Operation was performed under ether. According to the note made by the surgeon at the time of operation, the polyp apparently arose from a bony projection from the right side of the pelvis, and extended into the rectum. A definite diagnosis of the condition could not be made. After the removal of the polyp, some clear fluid was found, the origin of which could not be determined, though it apparently did not come from the bladder and no opening could be found in the base of the pedicle of the polyp. The pathological specimen was a polyp 3 centimeters in length (Fig. 2).

The patient did well until 4 days after operation when symptoms of meningeal irritation appeared. Spinal puncture revealed infection with colon bacillus, streptococcus, and an organism resembling pneumococcus, with numerous pus cells. The severity of the meningeal symptoms increased rapidly and the child died on the night of the fifth day after operation.

Only regional examination was permitted at necropsy, at which the entire sacrum was removed. There was a large opening on its anterior surface through which a meningocele emerged into the pelvis. From the position of the ligature which remained from the operation, it was found that the pedicle of the polyp was attached to a bony projection which formed part of the upper margin of the hiatus in the sacrum. The wall of the sac forming the meningocele was continuous at this point with the pedicle, and it was evident that this evagination of the sac had been cut across when the pedicle was severed. At the same time the avenue of entrance of the infection which resulted in fatal cerebrospinal meningitis was evident. Roentgenograms were made of the sacrum after its removal which show quite plainly the character of the deformity. In one, the hiatus in the bone is plainly seen (Fig. 3). The other, a lateral view, shows the bony projection at the upper part of the hiatus (Fig. 4).

The point of practical importance to be emphasized is that when a rectal polyp is found, search should be made for such an abnormality as is reported here. The presence of a congenital deformity of the sacrum was known in this case before operation, this knowledge having been established both by roentgenogram of the lower spine and by rectal palpation of the bony protuberance which extended forward from the sacrum. The spina bifida, however, was designated as one of the occult type, inasmuch as there was nothing noted on clinical examination of the spine. Since there was no motor disturbance of the lower extremities and urination and defæcation were maintained, that is, there was no neurological derangement due to spina bifida, it was thought to be of no special significance. On repeated rectal examination, the examining finger did not come in contact with the meningocele and none was suspected. Operation having been performed and the interior of the meningocele having been infected, the actual condition was soon revealed by subsequent events. A large percentage of the cases of anterior sacral meningocele which have been reported have also terminated fatally, possibly because of failure to recognize the real condition.

Since Bryant, in 1858, published the first account of anterior sacral meningocele, 19 similar cases have been reported. Three of these occurred in children. Grossman described one in a child of 10 months, in which the stalk and sac passed posteriorly around the side of the sacrum, becoming visible as a swelling in the gluteal region. Roux reported a case occurring in a child aged 8 years. In this instance a large meningocele, adherent to the rectum and communicating with the spinal canal by an opening situated a little to the right of the median line, was removed at operation. Complete recovery followed. In Hofmokl's

[1]Submitted for publication March 5, 1926.

Fig. 1. Rectal polyp.

Fig. 2. Gross appearance of rectal polyp.

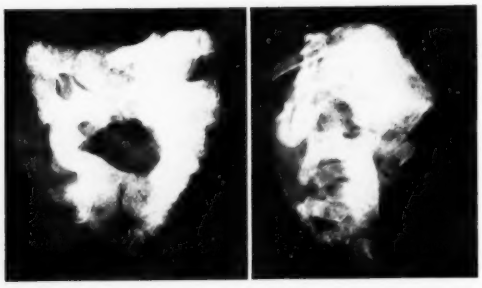

Fig. 3 (left). Anteroposterior roentgenogram of sacrum, showing marked deformity and large opening on anterior surface.

Fig. 4. Lateral roentgenogram of sacrum. The polyp was attached to the tip of the bony protuberance that extends to the right. The opening in the sacrum from which the meningocele emerged is just below this protuberance.

patient, a boy aged 11 years, there was a tumor in the right iliac fossa. The cause of death was not stated, but at necropsy part of one of the bodies of a sacral vertebra was found to be absent and there was an enlargement of the resulting intervertebral space with a meningocele which formed the tumor.

The cause of anterior sacral meningocele is not known and the author has no hypothesis to offer which might account for its occurrence.

SUMMARY

A case of rectal polyp associated with anterior sacral meningocele in a child aged 22 months is reported. The simultaneous occurrence of the two conditions has not been reported previously. Anterior sacral meningocele is a rare condition, only three cases in children having been previously reported. The cause of anterior sacral meningocele is not known.

The case illustrates the necessity of excluding the possibility of anterior sacral meningocele in cases in which rectal polyp is to be removed.

BIBLIOGRAPHY

1. Bryant. Meningocele sacralis anterior mit Schwangerschaft komplizirt. Canstatts-Jahresb., 1858, iv.
2. Grossman, Emil. Eine seltene Form der Spina bifida cystica. Jahrb. f. Kinderh., 1906, lxiii, 224–234.
3. Hofmokl. Ueber das Wesen und die Behandlung der Spina bifida. Med. Jahrb., Wien, 1878, 443–466.
4. Roux, Zusanne. Contribution à l'étude de la méningocèle sacrée antérieure. Rev. méd. de la Suisse, 1918, xxxviii, 47–71.

STRANGULATED UMBILICAL HERNIA

With Report of Two Cases, One a Baby Fifteen Hours Old

By L. LEYVA PEREIRA, M.D., F.A.C.S., Bogota, Colombia, S. A.

TWO cases of strangulated umbilical hernia are presented as curiosities. The fact that one case occurred in an infant and the other in a woman of 70 years would seem to show that surgery properly conducted can afford assistance both in the alpha and omega of life.

Case 1. Male infant. Mrs. G., 36 years of age, married, with nothing of interest in the family history, had had since her marriage 11 years ago, 3 children. Nothing unusual occurred either before or at the time of the birth of any of the children and all three of them enjoy excellent health. After the birth of the third child, the patient suffered an attack of bronchial pneumonia as a result of influenza. This caused endocarditis with a resulting diastolic thrill in the right ventricle. In addition the kidney was affected by the influenza. Therefore during the attack of bronchial pneumonia and for several days afterward, the urine showed traces of albumin.

In this condition, in February, 1925, Mrs. G. became pregnant for the fourth time. The feet became swollen, the veins of the neck dilated, and from time to time the patient experienced violent headaches which were relieved only by the water diet ordered by the specialist. The least departure from the treatment prescribed, however, brought on the symptoms with increasing violence.

The thyroid glands grew considerably during the later months of pregnancy; one could almost see them grow. The slightest exercise brought on fatigue more or less intense. The urine showed traces of albumin and the amount secreted was small.

On September 6, 1925, the eighth month of pregnancy was entered upon, and on this date, we were urgently summoned because the patients condition was very serious, as she had a short time previously suffered from a violent attack of asphyxia. The face and extremities were excessively cyanotic. A bloated appearance with the veins of the neck extremely dilated, gave the impression that the face had increased considerably in size. A continued disturbed mental condition together with hypertension of pulse completed the picture of a somewhat alarming situation.

While awaiting the arrival of the doctor in charge of the case, I wished to effect a blood letting, but before I had completed my preparations an abundant hæmoptysis occurred which somewhat relieved the patient. This prevented the blood-letting, since of course one could not foresee if the hæmoptysis would recur or not. The doctor in charge decided that since the condition of the mother was poor and no fetal movements could be observed, early delivery should be effected by manual dilatation.

About an hour after these manipulations, a male child was born in a complete state of asphyxiation and did not begin breathing until after half an hour's artificial respiration. Probably as a result of the movement and handling necessary to restore respiration, a part of the small intestine was ruptured and could be seen perfectly through a transparent area around the umbilical cord. The intestine was reduced to its normal position and an ordinary compression bandage applied. During the night the child cried and showed signs of intense abdominal pain.

At 6 a. m. on September 7, the child began to vomit, and I was called by the doctor in charge. Complete intestinal obstruction was present with meteorism and intense pain which increased when the abdomen was touched. Across the jelly of the umbilical cord could be seen the intestinal tube dilated and dark in color, and the meconium contained within.

There remained no hope of life other than by operation, inasmuch as the intestine could not be reduced to its normal place by external means. At 8 a. m., that is to say, 15 hours after the birth of the child, I proceeded with the operation, assisted by Doctor N. Buendía. Two drops of chloroform in a compress sufficed as an anæsthetic; this was administered by Señor H. Anzola Cubides, a pupil under my charge. The skin was painted with a tincture of iodine and a small incision was made near the left side of the navel; the obstruction which was causing the strangulation was cut from within out. This method was adopted in order to avoid peritoneal contamination, a possibility which might have arisen had it been performed the opposite way. The intestine was reduced with the greatest ease. A peritoneal suture was made with No. 00 catgut and the skin and muscles were sewed together with No. 1 chromic catgut. The operation lasted 15 minutes and the child awoke completely transformed. A few minutes later the first meconium discharge took place. The child slept peacefully and without further trouble.

My attention was drawn to the firmness of the peritoneum of the infant, which was easily sewed up with a small curved needle. I had very little hope of the powers of resistance of a child prematurely born under the conditions described. Also I was surprised that the operation could be performed on a child with such facility and that no complication ensued after an operation which is invariably serious for adults.

Case 2. Señora J. de C., aged 70 years, married, for 20 years had had an umbilical hernia which caused strangulation on October 5, 1924. The operation which was performed under spinal anæsthesia induced with a 5 per cent solution of sincaine, was carried out in the country under somewhat unhygienic conditions. The transverse colon was found to be strangulated and gangrenous in appearance. It did not react to hot water. In view of this I decided to perform the Mikulicz operation designed for malignant tumor of the intestine. After 8 days the resection was done under local anæsthesia and strong forceps were placed on the two tubes of the large intestine. These were left outside the skin like the barrels of a gun. Within 5 days, lateral communication was established in the intestine, the stercoral fistula closing itself completely 90 days after the first operation.

The principles of the operation used in Case 2, were presented in an article by Charles Mayo in Surgery, Gynecology and Obstetrics. The results could not have been better than those in this particular case.

DISTURBED REFLEXES; THEIR SIGNIFICANCE IN ACUTE ABDOMINAL DISEASES

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In no region of the body is disturbance of reflexes of such important diagnostic value as in the abdomen. Though lives depend largely on the speedy and correct interpretation of these clinical disturbances, yet we still find the symptoms of such a well known disease as acute appendicitis imperfectly understood or misinterpreted even by experienced clinicians. We are all too prone to accept textbook statements without proof and without due consideration. Many teachers of clinical surgery teach this subject badly, and we are forced to the conclusion that they do not teach clearly because they do not themselves clearly understand. Mr. Zachary Cope, who has recently published "Clinical Researches in Acute Abdominal Disease," is a notable exception to the great army of writers on such a subject and he is to be congratulated on his work. This author's name is mentioned because, in the writer's opinion, he is the first who has shown that he understands and appreciates the important clinical meaning of the disturbed reflex in acute abdominal disease.

The first thing that should strike a clinician, and particularly an operating surgeon, is that, in a definite lesion such as acute appendicitis, absolute uniformity of symptoms is not found. In the past, and even today, such discrepancies have usually been explained by the "lie" of the viscus; that is, whether it dips into the pelvis, lies behind the ileum, points toward the spleen, or is retrocæcal in position. It must, however, be of amazing interest to an experienced surgeon during his appendix operations to discover the organ in a "lie" which he had not anticipated. His explanation of the symptoms as they had presented themselves requires revision. Moreover, the condition of the affected appendix very often surprises the operator who has imagined that it will be a non-perforated viscus he is about to remove, or having diagnosed perforation, finds the organ simply inflamed.

As Mr. Zachary Cope has emphasized the significance of rigidity it will probably be advantageous to discuss this reflex disturbance first and leave others, such as pain and vomiting, to a later part. It will be noted that in this series of cases rigidity was found only (1) when the diseased appendix was adherent directly to the "demonstrative area of the parietal peritoneum" (Cope); (2) when it was adherent to the omentum or to a neighboring coil or coils of intestine which in turn adhered to the "demonstrative area of parietal peritoneum"; or (3) when there was no evidence of any recent direct adhesions as in (1) or indirect as in (2), but when the "demonstrative area of parietal peritoneum" had been bathed in toxic pus for a lengthy period and was noted at the operation as distinctly inflamed. Here lymph adhesions may have been present and subsequently detached by the pressure exerted by the purulent effusion. The term "demonstrative area" is, on the whole, good, and Mr. Cope defines it as the whole peritoneal lining of the abdominal cavity, minus the pelvis and central and inferior parts of the posterior abdominal wall—the "silent area." By "silent," he means, of course, non-demonstrative to our present clinical methods of examination. The author contends that the abdominal muscles, or even certain areas of them, which show *rigidity*, locate the recent *adhesions* associated with the diseased viscus; as in (2) when the viscus itself is adherent, or in (1), they locate its position very accurately. Rigidity, when diffuse and extreme, is due to pronounced inflammation of the parietal peritoneum bathed in toxic pus, a condition very frequently associated with recent adhesion between gut, omentum, etc., and abdominal wall.

Against Mr. Cope's "silent area" might be mentioned such clinical symptoms as inability to void, the bladder requiring catheterization; rigidity of the iliopsoas muscle; and rigidity

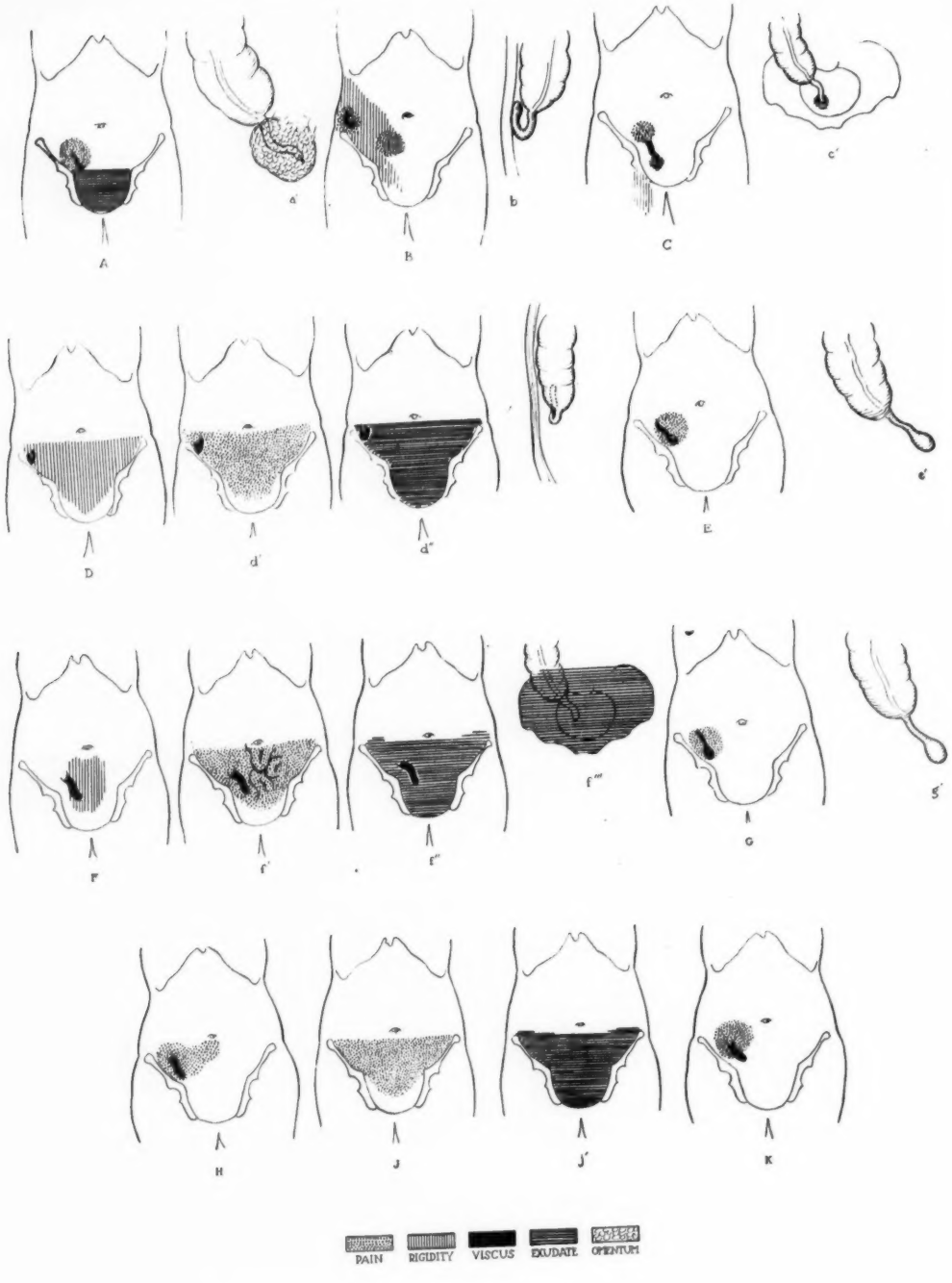
of the obturator internus muscle. These have all been demonstrated in many cases of acute appendicitis and have had their own particular significance. Moreover, as rigidity is a reflex phenomenon one would not expect the muscles of the anterior abdominal wall to respond to an afferent stimulus unconnected with them; for instance, from the silent area. The "overflow theory" of reflex action is difficult to disprove but it is also difficult to prove and need not be seriously considered. The "silent area" of the pelvic peritoneum would strongly suggest a negative to such a theory. The writer, however, maintains that this "silent area" does not really exist as such. Its responsiveness only awaits proof by more thorough clinical examination, which is often admittedly difficult to carry out in urgent conditions.

Rigidity in most textbooks and by most lecturers known to the writer, is described as a *visceromotor reflex*. Such a definition in the light of clinical observation is almost certainly incorrect. Its acceptance seems to have led to continued and profound misunderstanding. Rigidity is a *sensori motor reflex*—both limbs of the reflex arc belong to the somatic nervous system. The afferent is a nerve of common sensibility; the efferent is a motor nerve. No rigidity is ever found unless the parietal peritoneum is involved—it matters little whether the area be large or small—the afferent stimulation is through the delicate plexus of sensory nerve fibers lying subendothelially in the parietal peritoneum. Strong sympathetic afferent stimuli from a diseased viscus are not responded by the contraction of a voluntary muscle, they are responded by a strong and continued reflex contraction of the plain muscle of the gut. That is the true visceromotor reflex. It is not a "sign" but is a "symptom," and is expressed by the patient as pain of a certain character and frequently located far away from the diseased viscus. The disturbed visceral reflex, therefore, has two elements: (a) the motor, powerful contraction of intestinal muscle, visceromotor visible only in a radiogram; and (b) the sensory, the translation of (a) as pain-viscerosensory.

In further considering pain we find that frequently in acute appendicitis the patient suffers epigastric or periumbilical pains. These are felt in areas far removed from the diseased viscus. They have been described as reflex "overflow" pains. They are not really so. The epigastric pain of acute appendicitis is due to a spasmodic contraction of the pyloric sphincter, and is correctly described by the patient as epigastric. The periumbilcal pain of acute appendicitis is due to strong peristaltic contraction of the lower ileum against a contracted ileocæcal sphincter, and is correctly described by the patient as periumbilical. This reflex disturbance is visceral —is a reflex of the autonomic nervous system. Visceral abdominal pain is due to vigorous peristalsis of involuntary muscle or contraction of sphincteric areas often at some distance from the point of stimulation. On the other hand the pain of parietal peritoneal irritation is felt close to the point irritated and this, in the author's experience, is coupled with definite, though frequently circumscribed, areas of muscular rigidity.

The primary pain of an acute attack of appendicitis is most probably due to vigorous peristalsis of the plain muscle of the appendix, and in a very large number of severe appendix lesions a definite stricture of the viscus is capable of demonstration. The final and frequent localization of the pain to McBurney's point is most probably due to a pronounced and persistent contraction of the ileocæcal sphincter with strong peristalsis of the lower ileum. This statement does not, of course, refer to local adhesive peritonitis which has been already considered.

The "chronic appendix," when it does exist, is diagnosed chiefly from the digestive disturbances it creates. While freely admitting that the appendix is frequently unjustifiably attacked by the surgeon in the treatment of many dyspepsias, we must grant that occasionally a dyspepsia is cured by appendicectomy, and, in such a case, undoubtedly, the pyloric spasm is reflex and due to the presence of the diseased appendix, the disturbed visceral reflex. Often, as is well known, during the progress of a case of acute appendicitis, pain lessens in severity, and such an eminent teacher as the late Dr. Murphy of Chicago taught that this occurred in gangrene of the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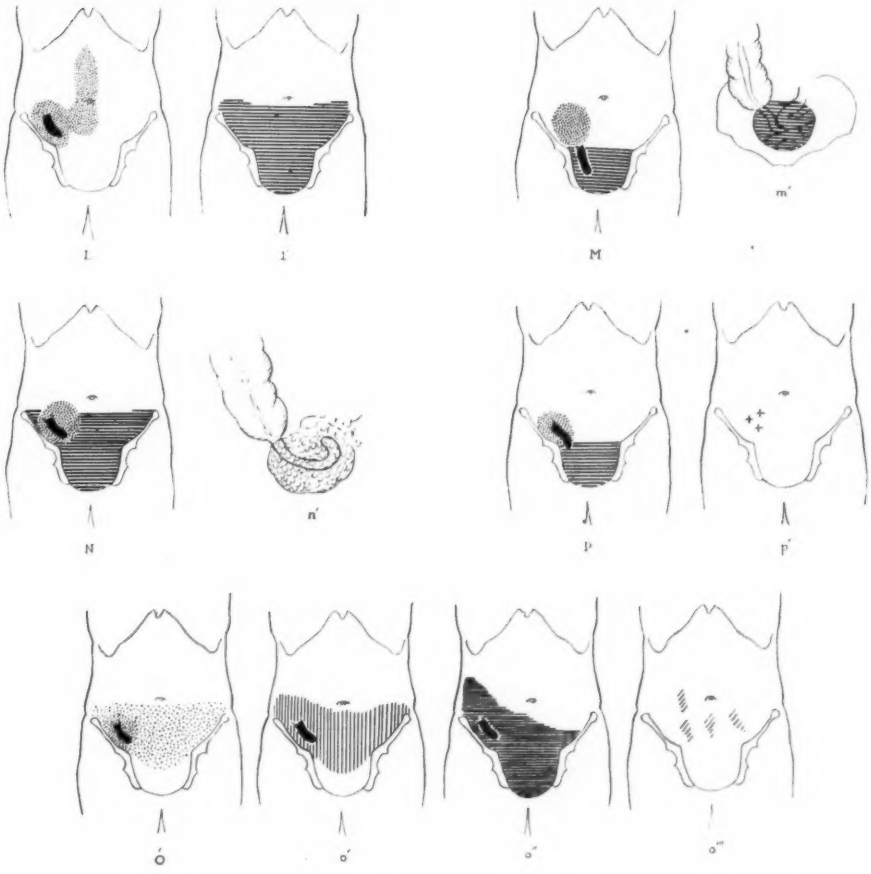

The author presents, for the purposes of this article, a series of recent cases (A. to P.) with explanatory and simple sketches made in the operating room. With one exception, a case of pneumococcal peritonitis, Case J., all are cases of acute appendicitis. Only the chief reflex disturbances are mentioned, with a minimum of irrelevant detail. Many more similar cases could be cited.

A, a'. Male, young adult, duration of attack 24 hours. Appendix enveloped in omentum, perforated at tip. No adhesions of enveloping omentum to parietal peritoneum. No adhesions of intestine to parietal peritoneum. Exudate in pelvis. Pain marked over McBurney's point. No rigidity, vomiting once only at onset of attack.

B, b'. Male, aged 12, duration of symptoms 56 hours. Rigidity well marked. Appendix retrocæcal and intraperitoneal, inflamed, distended, and adherent by lymph flake to the parietal peritoneum of the flank; no gangrene nor perforation; no adhesions of gut to peritoneum; no exudate. Pain marked over McBurney's point and in the flank; vomiting at onset of attack.

C, c'. Male, young adult, duration of attack 4 days. Appendix found in pelvis, gangrenous and small abscess at tip which was adherent to posterolateral pelvic wall. Some difficulty complained of in fully extending the thigh; also difficulty in passing urine, retention. No rigidity of anterior abdominal wall muscles. Pain marked over McBurney's point. Vomited at onset of attack.

D, d', d'', d'''. Male; young adult, duration of attack 30 hours. Appendix retrocæcal and intraperitoneal, gangrenous and perforated, adherent to parietal peritoneum by recent lymph; a few coils of intestine adherent to parietal peritoneum of anterior abdominal wall. Effusion thick and purulent, considerable quantity. Rigidity well marked, especially over the site of the appendix. Pain over McBurney's point and over whole of lower abdomen.

E, e'. Female, young adult, duration of attack 12 hours. The appendix, showing a few old velamentous adhesions, its distal end distended and œdematous—lay in the right iliac fossa. No effusion, no rigidity. Pain marked over McBurney's point and in epigastrium. Vomiting repeated and bilious in character.

F, f', f'', f'''. Female child, aged 8, duration of attack 50 hours. Appendix very inflamed and gangrenous at the tip, moderate amount of pus in pelvis and lower abdomen

Position of appendix pointed downward and inward and dipped into pelvis. Coils of small intestine glued together by lymph and adherent to parietal peritoneum of anterior abdominal wall. Pain diffuse over lower abdomen. Rigidity, which was very marked, recti muscles, directly in front of the adherent coils of intestine, was also found but not so distinctly in right and left iliac fossæ. Vomiting on the first day of the illness.

G, g′. Female, aged 10, duration of attack 18 hours. Appendix showed a "catarrhal attack." The distal end very bulbous, position in right iliac fossa. Pain over McBurney's point, no rigidity. Vomiting had been very troublesome since the attack began.

H. Female, young adult, obese. Duration of attack 18 hours. Appendix in right iliac fossa, acutely inflamed and distended by foul purulent secretion, no adhesions nor recent lymph, no effusion. No rigidity, pain was very acute over McBurney's point and periumbilical. Vomiting had taken place several times.

J, j′. Case of pneumococcal peritonitis. Female, aged 8; duration of attack 12 hours. Pain felt over lower abdomen, no rigidity. Free pus in pelvis and lower abdomen.

K. Female, aged 17, duration of attack 24 hours. Appendix sausage shape and distended, inflamed, no adhesions old or recent, no exudate. "Pericolic membrane" present. No rigidity, pain severe and over McBurney's point. Vomiting ushered in the attack and had recurred.

L, l′. Male, adult, duration of attack 24 hours. Appendix in right iliac fossa sausage shape, distended and very inflamed, no gangrene nor perforation. Purulent effusion in pelvis and lower abdomen, no adhesions anywhere, no lymph. No rigidity; epigastric, periumbilical pain was felt also in right iliac fossa. Had vomited twice.

M, m′. Male, young adult, duration of attack 3 days. Appendix in pelvis surrounded by adherent loops of gut, these not adherent to pelvic or abdominal peritoneum. Appendix gangrenous but not perforated. Effusion in pelvis and lower abdomen seropurulent. No bladder symptoms, no rigidity. Pain severe over McBurney's point.

N, n′. Male, young adult; duration of attack 12 hours. Appendix, enveloped by adherent omentum, was very large, sausage shaped, acutely inflamed and distended with pus. Enveloping omentum not adherent to anterior abdominal wall. No adhesions of gut to abdominal wall. Effusions seropurulent in pelvis and lower abdomen. No rigidity, pain very marked over McBurney's point. Had vomited twice.

O, o′, o″, o‴. Male child, aged 6; duration of attack 4 days. Appendix in right iliac fossa, gangrenous and perforated, very foul pus in lower abdomen and pelvis and along right paracolic gutter. Coils of intestine adherent to parietal peritoneum of anterior abdominal wall at points marked in o‴. Rigidity extensive over lower abdomen. Pain very marked over whole lower abdomen, especially over McBurney's point. Parietal peritoneum very much thickened and inflamed. Vomiting marked on the first and fourth days of attack.

P, p′. Male, young adult; duration of attack, 7 days; acute pain 12 hours' duration, walked into hospital. Appendix very much enlarged in right iliac fossa but its distal extremity just reached the brim of the true pelvis. It showed two patches of gangrene and perforation. The tip of the appendix was adherent to the peritoneum over the pelvic (true) brim but nowhere were there any adhesions to bowel or bowel to abdominal wall. Purulent effusion in the pelvis. No rigidity was present and the enlarged, diseased appendix could be easily palpated before operation through the abdominal wall at $\frac{XX}{X}$ Fig. p′. The patient had a moderate degree of pain over McBurney's point, but no vomiting.

appendix. He argued that a dead appendix could have no pain because the nerves of the appendix were dead, and he accounted for other variations in signs and symptoms in a manner which could not in these days be termed scientific. The author goes further than Dr. Murphy in saying that not only has a dead appendix no pain but that a living one can be traumatized without pain just as a colostomy can be made painlessly in a conscious patient whose spinal medulla is intact and active.

It might be said of the referred pain of acute appendicitis that the afferent sympathetic impulse is visceral (appendicular wall) the response efferent sympathetic to viscera (pyloric and ileocæcal sphincteric spasmodic contraction), the latter causing vigorous peristalsis of the ileum; and that these, referred to corresponding spinal segments are interpreted as epigastric pain, right iliac pain (McBurney's point), and umbilical pain. It is very necessary to understand that these referred pains are not "overflow" in the purely sensory cerebrospinal segments.

Cutaneous hyperæsthesia over the appendix region is a reflex which may be easily interpreted. The writer feels bound to say, however, that he has failed more often than he has succeeded in demonstrating it in acute appendicitis. It is more easily found in chronic catarrhal types of the disease. Some observers have noted an actual diminution of cutaneous sensibility in certain cases.

Vomiting in acute appendicitis is a very variable phenomenon. In many acute lesions it is absent. In many simple catarrhal attacks it is pronounced. This reflex disturbance is often most severe soon after the beginning of the attack of epigastric abdominal pain. It would appear to be most prominent in the type of appendicitis in which the viscus is large and distended in whole or in part. It should be considered a result of the visceromotor half of the disturbed visceral reflex.

The late vomiting occurring in advanced cases of appendicitis with septic peritonitis need not be discussed here.

In conclusion, what has been said of acute appendix mischief and its reflex disturbances, applies equally to acute lesions of the stomach,

duodenum, gall bladder, etc. Adhesions between two viscera neither of which is adherent to the parietal peritoneum may reflexly disturb the function of either organ and cause visceral pain. They do not, however, cause the same type of pain as adhesions between a viscus and the abdominal wall.

SUMMARY

Pain in acute appendicitis is of two distinct varieties:

1. Localized pain due to localized peritonitis of the parietal peritoneum, that is, involvement of the sensory nerves in the subendothelial layer in this area. This is accompanied by a corresponding localized tenderness of the abdominal wall. It is also accompanied by rigidity of the overlying parietal muscle in whole or only in part. It is never a referred pain.

2. Pain due to visceral muscle spasm. This is without definite tenderness of the abdominal wall, is never accompanied by rigidity, is frequently localized over the appendix area, but is also very frequently "referred" to the regions of the epigastrium and the umbilicus.

Additional note. Several of my surgical colleagues have asked me to explain why, if my conception of these reflex disturbances is correct, rigidity of the abdominal muscles is found during an attack of renal colic, when the extraperitoneal nerves are certainly not involved. My answer is that muscular rigidity in renal colic cases differs essentially from the rigidity found in acute abdominal inflammatory conditions. Renal colic rigidity is not steady and persistent, it is intermittent in character, it is pronounced for seconds or minutes, then it disappears only to reappear, and so on, until the attack of acute pain is ended. Its intermittent character suggests its cause. This type of rigidity is simply an exaggeration of the normal reflexes associated with normal micturition.

When the act of micturition is initiated the abdominal muscles contract to aid the muscle of the bladder wall in expelling the urine. The muscular fibers of the ureter are continuous with those of the bladder, contraction of the former is followed by contraction of the latter. Severe peristalsis of the ureteric muscle—renal colic—gives rise to severe peristalsis of the vesical muscle—frequent desire to micturate—accompanied by strong contraction of the abdominal muscles—the so-called rigidity—with retraction of the testis. It may not be generally known that elevation of the testis in a lesser degree occurs at the end of normal micturition.

Renal colic rigidity, therefore, resembles neither in its persistency nor in its causation the rigidity associated with certain acute abdominal diseases.

EDITORIALS

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DECEMBER, 1926

THE ROENTGENOGRAM AS AN AID IN THE DIAGNOSIS OF BONE TUMORS

WITH experience in the interpretation of roentgenograms the surgeon may correctly diagnose most tumors of the osseous system, but without it he will save himself from error and embarrassment by using circumspection and inviting aid in their interpretation. The roentgen-ray is without doubt the most valuable pre-operative aid in diagnosis and prognosis. Not only does it depict the local character of the growth but it also permits the differentiation of single and multiple forms of certain tumors. With the diagnosis of the tumor the surgeon immediately faces the question of benignancy and malignancy.

The character of the local growth, its origin and site, its osteoclastic or osteoplastic properties, the condition of the medulla, cortex and periosteum, the presence of invasion into the periosseus structures or localization within the osseous structures have a bearing on the diagnosis. Should the tumor be benign, it may be either single or multiple. Should it be malignant, the question of metastasis arises. Here again the roentgen-rays are invaluab'e as the multiple forms are recognizable long before clinical evidence is available, and pulmonary metastasis may be discovered by the aid of the roentgenogram before any symptoms appear in the lungs and even before a primary lesion is suspected.

Certain tumors appear in the diaphysis but rarely invade the epiphysis, as is illustrated by the group of osteitis fibrosa cystica in which the epiphyseal line appears to be a bar to growth. On the other hand, chondroma, giant-cell tumors and sarcoma usually involve the epiphysis. Tumors may cause absorption of bone from without, giving rise to a clear-cut area of destruction as in periosteal sarcoma, fibroma, and so forth.

The exclusion of inflammatory lesions, syphilis, metastasis from carcinoma and so forth, usually presents little difficulty. However, the surgeon will enhance the accuracy of his diagnosis if he obtains further aid through the history, clinical examination and laboratory findings, and co-operates with the roentgenologist.

While the diagnosis in most cases of bone tumors may be made from the roentgenogram alone, there is a small group which may baffle the expert; and here the value of the history, clinical findings, laboratory tests and gross and microscopic examinations should not be overlooked.

Both diagnosis and prognosis are often illuminated, sometimes profoundly changed indeed, by the knowledge contributed by thorough analysis from all aspects. More skillful diagnosis and more accurate estima-

tion of life-expectancy depend on how carefully the present available facts are balanced with each other. HENRY W. MEYERDING.

THE CANCER SYMPOSIUM AT LAKE MOHONK

CONVENED by the American Society for the Control of Cancer, a notable group of European and American physicians engaged in work on various phases of the cancer problem, met at Lake Mohonk September 20–24, 1926. The announced intention of this symposium was to "express in concise language the fundamental groundwork of fact and opinion upon which the collective effort now being made in the United States for the control of cancer should be continued and extended . . . The aim is not to start discussion, but to crystallize existing knowledge; not to initiate investigations, but to report upon those productive ones which have already been made; not to raise doubtful points, but to emphasize the agreements that can be arrived at on the basis of existing knowledge."

Representatives from England, France, Germany, Holland, Belgium, Denmark, and Switzerland, joined with the Americans in discussing the subjects that had been assigned them. The subjects considered were the organization of the work for the control of cancer in the different countries; the equipment of institutes for diagnosis and treatment; the hospitalization of patients; and professional and lay education.

Much emphasis was placed on the necessity of early diagnosis and means were discussed for getting the patients to consult the doctor in the early stage, which is the only stage offering reasonable hope of relief in the majority of cases. Prevention of cancer and its dependence on pre-existing inflammatory conditions, was ably discussed. Regarding the etiology of cancer, there was some disparity of opinion, some favoring the parasitic theory, and some being unalterably opposed to it. The rôle of heredity as an important factor in human cancer was minimized by most of the speakers. Co-operation in diagnosis and treatment were shown to be a *sine qua non* for success, and shame was poured on the head of the doctor who claimed all sufficiency in diagnosis and treatment. The value of continued investigation into the cause and best methods of diagnosis and treatment was emphasized.

At the conclusion of the symposium, a statement was issued purporting to express the consensus of opinion of those present on the subjects discussed.

This symposium has been productive of much good in showing the world-wide interest in the subject of cancer prevention and treatment, and in bringing together as never before a group of men from different countries to show the way in which this problem is being attacked in their respective countries. Doubtless all present have gained from the exchange of ideas and will carry away new ideas of methods to apply in their own countries. Certainly we in the United States and the American Society for the Control of Cancer now know more of how it is being done elsewhere, and have a better foundation on which to base our own work in this direction. Coordinated international effort has been productive of much good in the attack on tuberculosis and on some of the more acutely infectious diseases.

It would have been futile to hope that all knowledge of facts concerning the cancer problem could be crystallized at one meeting of this nature. Until the cause, the means of diagnosis, and the infallible methods of treatment of cancer are known, conservatism is the

part of wisdom and one cannot be too dogmatic in the matter. Certainly the statement issued at the close of the symposium was conservative. One is led to wonder whether there are not more positive statements that may be made profitably without overstepping the bounds of prudence. Are there not now certain points on which all authorities are practically agreed that are not known to the general run of those who daily come into contact with cancer cases in their homes and in the clinics? We believe the answer should be in the affirmative.

If this be so, then it must be possible that these facts can be collected and impressed upon the physicians by some group of authorities or organizations competent to speak on the subject. Some of the questions which might be submitted to such an organization with reasonable hope of general agreement and helpful answers, will readily suggest themselves to those familiar with cancer problems.

1. Of what practical benefit to the practicing physician at the present time is the conception that cancer may be due to a parasitic cause?

2. A non-parasitic cause?

3. The ultimate criterion of malignancy is microscopic examination by a competent pathologist. In how far is diagnostic local incision into a suspected tumor justifiable?

What are the dangers of incisions into tumors? In what types of tumors is such danger the greatest?

4. Excepting skin cancers, what is the effect of pre-operative and postoperative X-ray or radium?

5. In what class of cancer cases is one now justified in treating by X-ray or radium rather than by surgery?

Such a statement of definite facts would supplement the statement issued by the American Society for the Control of Cancer and help to solve present problems, help to save lives, and help to keep the public away from the cultists who find such easy prey in the fearful and credulous cancer patient.

BOWMAN C. CROWELL.

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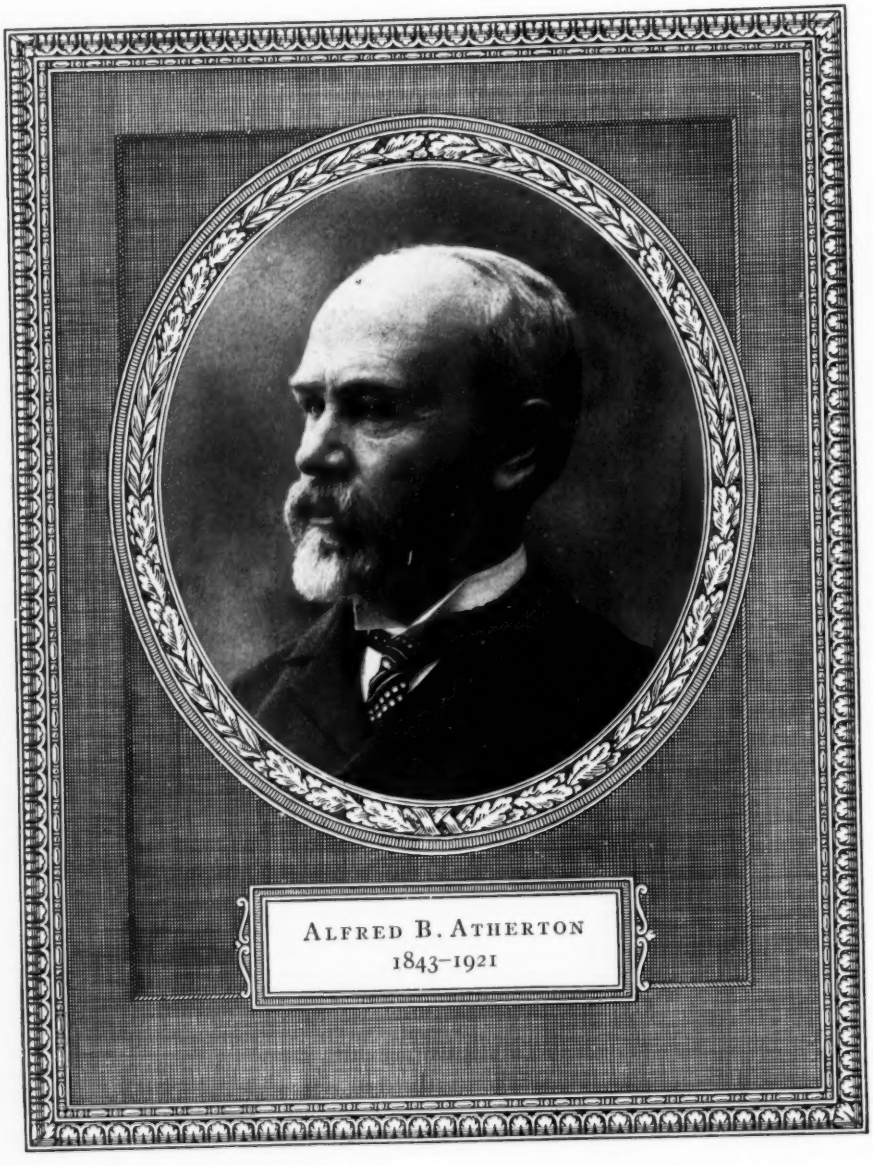


ALFRED B. ATHERTON
1843–1921

MASTER SURGEONS OF AMERICA

ALFRED BENISON ATHERTON

ALFRED BENISON ATHERTON, B.A. University of New Brunswick, 1862; M.D. Harvard, 1866; L.R.C.P. & S. Edinburgh, 1868; LL.D. University of New Brunswick, 1900; a charter member of the American College of Surgeons; was born at Queensbury, York County, New Brunswick, January 22, 1843; son of John and Charlotte Perley Atherton, of Puritan stock, who migrated from New England about 1760. On his return from Europe where he had gone for postgraduate study, he began his practice in Fredericton but a few miles from his birthplace. Here he evidenced unusual proficiency in surgery.

In 1884 he sought larger fields for his usefulness and removed to Toronto where he became attached to the teaching staff of the Women's Medical College, his subject being "The Principles of Surgery." He was appointed surgeon to St. John's Hospital for Women of Toronto. He returned to Fredericton in 1898 and was appointed to the Surgical Division of the Victoria Public Hospital.

Doctor Atherton was a man of pronounced aggressiveness and vigor, rather inflexible in his views, with brusque mannerisms which to his friends were characteristic, but among those who knew him not, or slightly, militated against him.

Doctor Atherton was house surgeon at the Massachusetts General Hospital after graduation, and was contemporaneous with many Harvard men who in no small degree contributed to the progress of American surgery. It was Dr. Atherton's custom to visit either European or American hospitals annually. Thus he kept in personal touch with the leaders in the surgical world. In fact, at any clinic or hospital in America where it has been my privilege to visit, especially at Baltimore, Chicago, New York, Boston, Minnesota University, or the Mayo Clinic, I always encounter some one who knew Dr. Atherton. Often when asked what my home town was, the mention of Fredericton, New Brunswick, Canada, would be followed by: "That's where Atherton hails from." I recall very well in 1905 when I called on the beloved William Osler at his home in Baltimore, just before his removal from Johns Hopkins University to Oxford, England, that he invited me into his library, and after showing me a few of his most prized volumes, and having interested me in their history he suddenly stopped and asked "How's Atherton? Does he do much fishing now?" Not a little of our time was spent in discussing Dr. Atherton, whom Sir William Osler held in high regard.

Our first meeting occurred in 1897 when I wired him as follows: "Come prepared to operate for extra-uterine pregnancy." He arrived by next train, a distance of 40 miles, and received me with a hearty hand shake and genial smile, at the same time remarking: "That was a rather peremptory telegram, and I am here as directed." My preconception of Dr. Atherton was entirely reversed. I fancied that he was a man of large physique, clean shaven, and very serious. The man I met, however, was of short stature, about five foot six, wearing a carefully kept grey Van Dyke beard, of marked physical activity, most affable, with a massive forehead and penetrating expression. We operated at the patient's home, utilizing the "kitchen table." She made an uninterrupted recovery, still enjoys good health, and since then it has been my privilege to attend her at several normal births. In those days the marine sponge was an essential in surgical equipment, and I well recall the little bag of them he had and the vigorous means he used to evacuate the clots, etc.

Nowadays, a surgeon who observed the technique employed then would be considered guilty of gross technical error. Nevertheless, one recalls the many instances of smooth, uninterrupted recovery resulting when Lawson Tait's simple surgical cleanliness held sway; and it is rather hard to understand how one ever got such good results from operations done in the country under most unfavorable environment, especially in cases of compound fracture, gall stones, appendicitis, tracheotomy, emergency gynecological operations, etc. Prior to that time I had never practiced in country districts and this experience with an abdominal section at the hands of Dr. Atherton made a lasting impression upon me. In this section of the country, we have produced many good surgeons, but there can be no doubt that Dr. Atherton was the pioneer par excellence, and that the rest of us received our impetus very largely through the example set by this gentleman.

Dr. Atherton figured among the first of a group of surgeons to have operated successfully for acute perforated gastric ulcer, being so mentioned in Denis's *System of Surgery*, issue of 1895, his name appearing in this connection with Kreige, Morse, Maclearn, Michaux, Rioux, Nicholson, Bennett, Schuchardt, and Kuester. It was the writer's fortune to have been associated with him in some of this work.

In common with all who have attempted extensive surgery, he has been criticized for overdoing the subject, and early in his career he became involved in a lawsuit for malpractice, wherein a man's arm was sacrificed in an attempt forcibly to reduce an old dislocated shoulder, wherein the axillary artery was atheromatous and ruptured under manipulation. The trial in this case resulted in a division in the profession in New Brunswick generally, but in Fredericton in particular, as many of the leading men in both the profession of law and medicine were summoned as witnesses, also men were brought from Montreal, Boston, and elsewhere. Thus a schism was born which lasted for many years and in fact died only with the Doctor's removal from here. There seems to have been no doubt that this unfortunate experience could very well have been avoided, especially as the patient

was that of another practitioner, who called at the Doctor's office for an opinion and not for an operation. The incident distressed him keenly, I feel quite sure, for in conversation he frequently referred to some phase of it.

Before his removal to Tortonto he taught a Sunday School Class in the Fredericton Methodist Church. This he continued to do for 10 years, and many men who were his pupils still speak of the impression made on their minds through him. He was a man of exemplary habits, not given to any but the simplest forms of amusement, notably fishing and curling. The latter sport he took up at the advanced age of 65 years, becoming probably one of the most ardent curlers known. It was a standing joke that when some one telephoned for Dr. Atherton when he was engaged in the game, he was always "too busy for an hour or more" to attend unless it was a case of extreme importance. He was very fond of children and often expressed disappointment that he and his wife had been deprived of them. His wife was a Miss Wiley, a native of Fredericton.

In politics he was an ardent Liberal, and a great admirer of the then Premier, Sir Wilfrid Laurier. In fact, he was persuaded in 1911 to accept nomination for the Federal House, and was making splendid progress in his canvass when he made a psychological misadventure of the worst kind for himself and the best for his opponent. It was during the election for Reciprocity with the United States. Senator Champ Clark in a speech in Congress at Washington was quoted as having threatened the annexation of Canada by the United States. While Dr. Atherton was making an address before a body of electors, he was interrupted by a heckler, who shouted: "What about annexation and the Stars and Stripes?" To which he in his impulsive manner replied: "What's wrong with the American Flag? I'd as soon live under it as any other." This undoubtedly contributed largely to his defeat, for at that time Champ Clark with his propaganda was heartily abhorred by the loyal Canadian; nothing more offensive could possibly have occurred to raise the passions of the voter and to have incited action in behalf of his opponent (which gentleman won out by a large majority).

In his day the automobile was not much in use here, and no one outstripped Dr. Atherton in his turnouts. He was a great lover of horses, and drove a span well mated and with lots of style. He would not tolerate a poor horse. To see him in his winter turnout was quite a picture, with flowing fur robes, beaver fur coat, black peaked fur cap, grey beard, heavy fur mits, and beautifully harnessed animals.

Dr. Atherton was one of the pioneers in surgery, having done some very advanced work. He attained quite a reputation throughout Canada and the United States. When he left Fredericton for California a group of us tendered him a dinner and presented him with a memento of our regard for him which visibly affected him. It was apparent then that he had about reached his limit physically. He lived in San Diego, California, from 1916 to the time of his death in 1921, at the age of 78 years, when he suffered a cerebral hæmorrhage. W. H. IRVINE.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

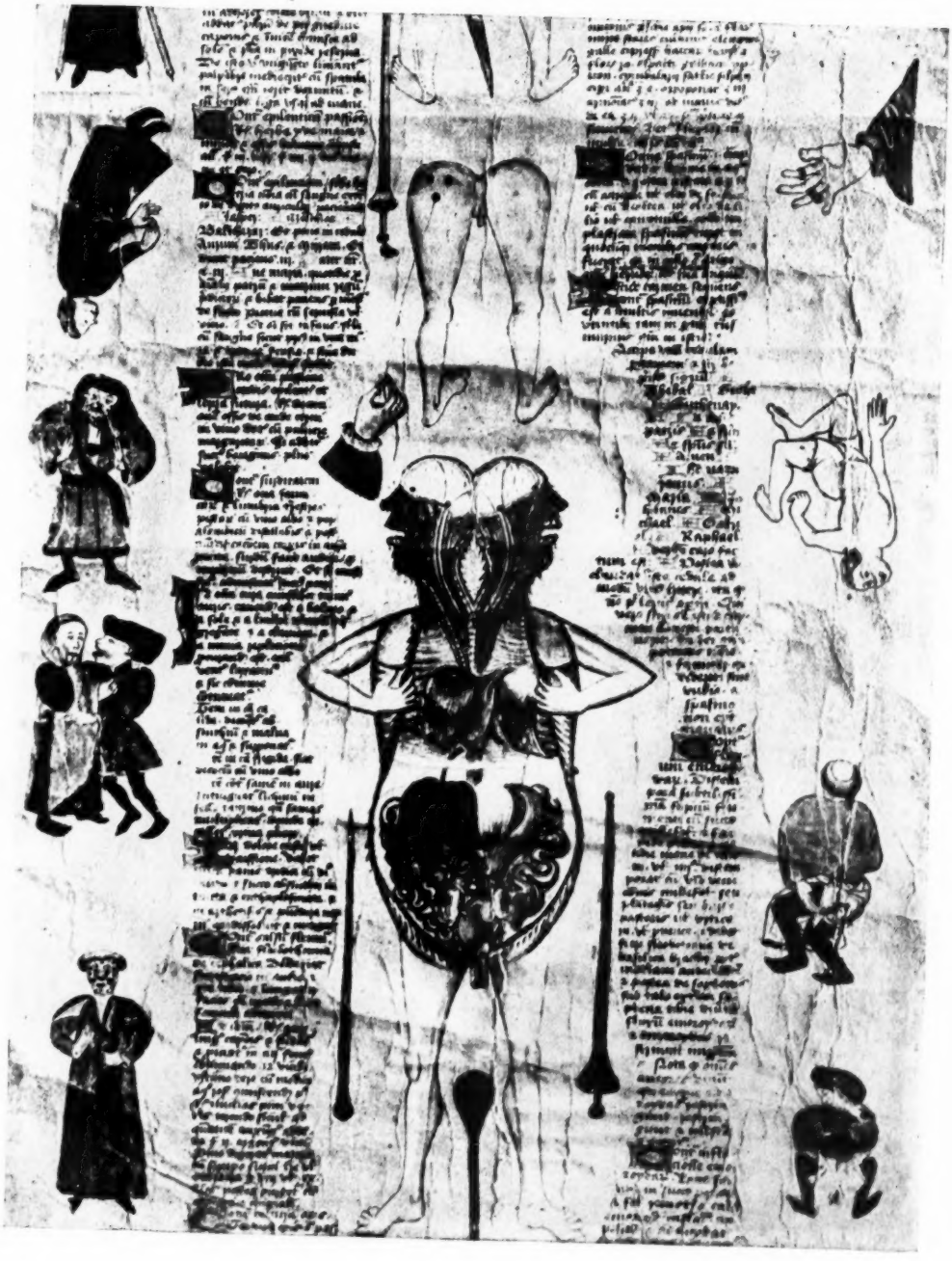
By ALFRED BROWN, M.D., F.A.C.S., Omaha

THE SURGERY OF JOHN ARDERNE

DURING the later years of the Middle Ages, surgery was gradually passing northward through Europe. The returning crusaders had brought with them from the orient the surgical practices of the Arabian school and Salerno, followed shortly by Padua and Bologna, had become the starting point of surgical teaching. Thence it spread northward and the universities at Montpellier and Paris were founded and with these the non-clerical Collège de St. Côsme where Lanfrancus of Milan, after having been refused a place in the University at Paris, taught the surgery which he had learned in southern Europe. It was only natural that the northward and westward march of the new medicine and surgery should continue and the foundation of the University of Oxford in England was the logical outcome. Gilbertus Anglicus and John of Gaddesden, the latter professor of medicine at Oxford, taught and wrote of medicine and included surgery, but their surgical work was little more than a compilation of that of the early Greeks with a smattering of the later Arabian, and England, in contradistinction to Italy, with Lanfrancus, and France with its numerous surgeons, the most outstanding of whom was Henri de Mondeville, had furnished no great surgeon. Then, to fill this vacancy and head a list of illustrious Englishmen came John Arderne. He was born just after the last crusade in 1307. Where he received his preliminary education we do not know nor does he tell us where he was trained in medicine. His preliminary education was good, for he wrote his surgeries in Latin which, for medical Latin, is excellent. That he received the complete medical training of the day, we may infer from the fact that he describes himself as "*Chirurgicus inter Medicos*," surgeon among physicians, which appears to mean that he became a physician with all the rights and privileges which that meant and then of his own volition, studied and practiced surgery. In 1346 we find him serving as sergeant surgeon in the army which, shipped to France in 1346 by Edward the Third, acquitted itself so well at Crécy. Here he obtained experience in the treatment of wounds. Upon his return he settled in Wiltshire and was there when the "Black Death" swept England in 1368. The following year, when 42 years of age, he moved to Newarke in Nottinghamshire and his name became inseparably connected with this location, for he is usually referred to as John Arderne of Newarke. He did not, however, remain in Newarke, for after having built up a great reputation as a surgeon and after having obtained a large practice, he moved to London, in 1370, and there, so far as is known, spent the remainder of his life.

Arderne's works have never been completely translated and printed. Some of the manuscripts have been made available, however, and all show that he made his chief life work the study of the treatment of fistulæ in various parts of the body and especially fistula *in ano*. One of the manuscripts, not written by him, but entitled "The Practice of Master John Arderne of Newarke in the Art of Medicine and Surgery" is dated 1412, and is in the library at Stockholm, Sweden. A photographic replica was made by the Wellcome Historical Museum. It was transcribed by Eric Millar, translated by Sir D'Arcy Power, and published by William Wood & Company, New York, in 1922. The illustration here shown is a reproduction of one of the pages in that publication and reveals an entirely new departure in surgical teaching, the application of the visual method. Anatomy and obstetrics had been illustrated previously and in the work of the Arabians, illustrations of instruments had been shown, but this man illustrated the surgical lesion and endeavored to teach by visualization of the living pathology itself. This method, as surgical teaching has gradually advanced, has been elaborated until today it is the basis upon which pedagogic methods rest. The discoveries in the allied sciences of physics and electricity have been adapted to our uses today. The microscope, X-ray, and electrically lighted instruments of visual precision play a great part in surgical diagnosis. The constant effort has been and is, to see the lesion wherever it may be situated, and to this man who lived more than five hundred years back, we must give the credit of having had the ingenuity to recognize the value of this method of transferring his ideas to others.

Arderne's greatest achievement in operative surgery was the evolvement of the radical operation for fistula *in ano*. By means of special instruments he split the tract and laid it wide open. Sometimes he did this with a cutting string which he called "*Frenum cesaris*" and sometimes with a knife, but always the fundamental idea was the same, wide opening of the tract, and thus he was the originator of the modern operation for fistula *in ano*.



UNIV OF MICH

REVIEWS OF NEW BOOKS IN SURGERY

THE Cameron Prize Lectures delivered at the University of Edinburgh in 1925 by Harvey Cushing[1] have been prepared by the Oxford University Press under the title of "Studies in Intracranial Physiology and Surgery." In his three lectures, Cushing admirably discusses the third circulation, the hypophysis, and the gliomata.

The study on the third circulation is a very lucid though not lengthy exposition of information, derived from experiments, on the origin of the cerebro-spinal fluid and its circulating pathways and their communications with deeper parts of the brain.

The discussion of the hypophysis or the pituitary gland, as it is now known, briefly sets forth our present-day knowledge of hyperpituitarism and hypopituitarism, the structure and function of the anterior and posterior lobes of the hypophysis, and tumors of the hypophysis.

The lecture on intracranial tumors and the surgeon deals with the technical, diagnostic, and pathological relationships of intracranial tumors. The lecture is concluded with a classification based on the histogenetic origin of intracranial tumors as worked out by Cushing and Percival Bailey.

R. F. MACDONALD.

A NEW work[2] has appeared for the guidance of the industrial surgeon as well as the general surgeon and the practitioner. In this volume Tarnowsky attempts to cover so-called "Emergency Surgery," and draws from the experiences of the World War those methods and procedures which were found safe and sane. He has had the courage to eliminate many old, time worn, and obsolete methods, replacing them with new and modern ideas. The book has a ring of distinct merit.

It is difficult in such a work to give sufficient data but not enough to make the work burdensome for reference. Much information is tabulated in a few well-chosen sentences, an attractive feature to the reader who prefers salient points covered briefly. This tabulation of essentials is especially well exemplified in the chapter on cranial injuries.

The subject of fractures is always the stumbling block in such a work because to be at all complete leads to an enormous text. The author has again shown wisdom in attempting to a considerable extent to cover only the early emergency treatment. The guide to neurological examinations is most valuable as is the chapter on the medicolegal aspect of emergency surgery.

J. A. WOLFER.

[1] STUDIES IN INTRACRANIAL PHYSIOLOGY AND SURGERY; the Third Circulation; the Hypophysis; the Gliomas. By Harvey Cushing, M.D. New York: Oxford University Press, 1926.

[2] EMERGENCY SURGERY; THE MILITARY SURGERY OF THE WORLD WAR ADAPTED TO CIVIL LIFE. By George de Tarnowsky, M.D., F.A.C.S., D.S.M. Philadelphia and New York: Lea & Febiger, 1926.

THE 1925 issue of the collected papers of the Mayo Clinic and the Mayo Foundation[3] once more places at the disposal of the medical profession in a concentrated form an enormous amount of valuable current medical literature. As in previous volumes, that material is selected which is of maximum interest to the practitioners of medicine while those articles of interest to the specialist in limited fields are given in abstract form or by title.

The liver and biliary passages and the thyroid gland are unusually well covered in this volume. The papers pertaining to these subjects are of intense interest to the medical profession.

The substance of this volume reflects the progress of present-day medical science and although every major subject is not covered, yet the scope is so wide as to indicate the great strides taken.

J. A. WOLFER.

ONE sign of the constantly widening interest in local anæsthesia is the number of new textbooks on this subject. Otolaryngology and rhinology have been among the first specialties to whose development local anæsthesia methods have greatly contributed. The new textbook of King[4] is the first in this field in the English language. After a short survey of the history of local anæsthesia and a brief discussion of the principal anæsthetic drugs and their toxicity, the technique of operations on the nose, sinuses, pharynx, larynx, and ear is described.

The word "anæsthesia" is misspelt in the book. Derived from the Greek *ἀναισθησία* the word is all too generally misspelt and should be corrected for æsthetic reasons. Great emphasis is laid on the preparation of the patient with morphine, magnesium sulphate, and novocain. The addition of the last drug is logical when it is desired to alleviate the burning pain of the hypertonic magnesium sulphate. The statement, however, that the addition of novocain (2 cubic centimeters of a 2.5 per cent solution) "definitely increases and prolongs the analgesic effect of the magnesium sulphate" (p. 51) does not seem to be very convincing. The animal experiments on which this statement is based have no bearing on the clinical interpretation. That a 1:150 solution of scopolamine given by mouth is the therapeutic antagonist of cocaine is very interesting, and in view of the fact that barbituric compounds have been proved to have the same effect, would deserve further explanation.

The submucous injection of saline with suprarenin is advised in submucous resections. Weak con-

[3] THE COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by Mrs. M. H. Mellish, H. Burton Logie, M.D., and Charlotte E. Eigen Mann, B.A. vol. xvii, 1925. Published May, 1926. Philadelphia and London: W. B. Saunders Company, 1926.

[4] LOCAL ANESTHESIA IN OTOLARYNGOLOGY AND RHINOLOGY. By James Joseph King, A.B., M.D. With Supplement on the Toxic Effects of Local Anesthetics edited by Emil Mayer, M.D., Chairman Research Committee on Local Anesthesia. New York: Paul B. Hoeber, 1926.

centrations of novocain seem more efficient and are surely harmless. In the description of the maxillary nerve block the palatinal approach described by Antonelli and the infrazygomatic approach of Payr are not mentioned, although they are particularly useful for rhinologists.

The statement that in mastoid surgery general anæsthesia is preferred, is to be heartily endorsed.

Of very great interest is the second part of the book, containing the reports of the various committees of the American Medical Association made to the Therapeutic Research Committee of the Council on Pharmacy and Chemistry. The conclusions and recommendations of these committees are so important that they should be placed in every operating room in a conspicuous place. It appears from the analysis of the 44 deaths attributed to local anæsthesia that all deaths from local anæsthetics are avoidable. The use of cocaine-mud is pronounced as dangerous. The quantity of cocaine used on swabs should be measured. It should never be injected in the tissues but used only as a surface anæsthetic in as low concentration as possible. To make mistakes on the part of druggists and nurses impossible the solution should be prepared in the operating room and the cocaine stained with fluorescein so that it will not be mistaken for novocain.

While the general surgeon will not agree with some minor details that have been pointed out in these reports, he has to acknowledge with hearty admiration the tremendous amount of work involved in the compiling and analyzing of the cases of death. In the previous literature of cocaine poisoning the extensive data compiled by Denk (1920) on the dangers of local and conduction anæsthesia would deserve to be mentioned.

As a whole, the book is very clear, it is concisely written and certainly fills a gap in this specialty.

G. DE TAKATS.

A MONOGRAPH on tuberculous disease of the hip joint[1], by Perkins, was awarded the Sir Robert Jones prize given by the British Orthopedic Association, and rightly deserves that recognition.

The author emphasizes the importance of the recognition of the presence of tuberculous disease at the earliest possible moment. He states that at the present time, treatment of bone and joint tuberculosis in England is local treatment consisting of recumbency, traction, and fixation, combined with general treatment—open air, hygiene, and heliotherapy. He reviews over 50 cases treated along these lines.

The book is excellently illustrated with many roentgenograms and photographs of various forms of apparatus, such as the Carshalton carriage devised by Dr. Pugh and the Pyrford frame.

The author takes issue with Phemister's explanation of the difference in the kind and degree of cartilage destruction in a pyogenic and in a tuberculous arthritis, and offers his own explanation of this phenomenon.

This little book should be read by every student, general practitioner, and orthopedic surgeon.

PHILIP LEWIN.

EFFICIENCY in surgical pedagogy is largely dependent upon painstaking attention to physiological and anatomical perversions. When the student has mastered the details of inflammation, gangrene, ulcer, sinus, fistula, and of the manner of origin, growth, and spread of malignancy, then and then only is he able to translate the special problems of appendicitis, peptic ulcer, or breast cancer into a problem of surgical pathology or pathological physiology.

An excellent introduction to surgery by Morison and Saint[2] fulfils these conditions. Its chapters deal with shock, wounds, hæmorrhage, infection, gangrene, specific infections, malignancy, and allied problems of special surgery. It is accurate, concise, systematic, and written in excellent English.

J. R. BUCHBINDER.

A BOOK on rectal diseases[3] has come to us which may be classed as one of the few books on this subject of practical value to the general practitioner.

In diagnosis, thorough examination is stressed, the methods described are fine, and warnings are given, the most important being that hæmorrhage is not to be accepted as a symptom of any one condition but of many diseases, among them cancer.

The diagnosis and treatment of medical cases are thoroughly covered. From the operative standpoint the book deals almost exclusively with those cases which the author feels may be safely operated upon under local or sacral anæsthesia without hospitalizing the patient.

FRANK DAVID.

IN the three-volume Therapeutique Chirurgicale,[4] of which volume iii dealing with the abdomen and genito-urinary system has just appeared, Lecène discusses the surgical treatment of various conditions in very much the same manner that the consulting surgeon would talk over a case with the internist.

The reader supposedly having a knowledge of semiology, physical diagnosis, and pathology, is presumed to have established the diagnosis. The authors take up the case at this point and attempt to show the indications for surgery, the general lines along which surgical treatment should be conducted, and finally the results which may be expected.

[1] THE DIAGNOSIS, TREATMENT, AND END-RESULTS OF TUBERCULOUS DISEASE OF THE HIP JOINT. By George Perkins, M.Ch. (Oxon.), F.R.C.S. (Eng.). New York: Humphrey Milford, Oxford University Press, 1926.

[2] AN INTRODUCTION TO SURGERY. By Rutherford Morison, M.D., F.R.C.S. (Edin.), F.R.C.S. (Eng.), M.A., D.C.L., LL.D., and Charles F. M. Saint, C.B.E., M.D., M.S., F.R.C.S. (Eng.). 2 ed. New York William Wood and Company, 1925.

[3] HANDBOOK OF DISEASES OF THE RECTUM. By Louis J. Hirschman, M.D., F.A.C.S. 4th ed. rev. St. Louis: The C. V. Mosby Company, 1926.

[4] THERAPEUTIQUE CHIRURGICALE. By P. Lecène and R. Leriche. vol. iii. ABDOMEN ET ORGANES GENITO-URINAIRES. By P. Lecène. Paris: Masson et Cie. 1926.

All the minor details of the operation are omitted; only the underlying surgical principles are mentioned. In dealing with prognosis the authors have been guided by their own results and those of others; tables of actual statistics, however, have been avoided. The authors have carried out their plans in a most excellent manner. Their reasoning is clear and logical and their advice sound, sane, and conservative.

The book is to be highly recommended to the general practitioner and the internist. It will tell them what the surgeon can do for them, what results they have a right to expect, and in a general way what procedures will be carried out. The surgeon will be intensely interested in this work as a study in surgical judgment.

The reviewer hopes that volumes i and ii will reach the same high standard as volume iii.

R. B. BETTMAN.

PHYSIOLOGY has influenced continuously scientific surgical investigation. While bone has undergone innumerable histological and experimental investigations, it is only gradually that histological study of specific cells to which the virtue of bone formation or against which the failure of bone formation in any given instance could be laid, has been influenced by general physiological principles.

In the preface of their small monograph on bone,[1] Leriche and Policard explain the book by saying that after 10 years' observation of the multiple aspects of normal and pathological evolution of bone, they have gradually felt thrust upon themselves a new understanding of the development, the life and the evolution, the diseases and the methods of regeneration of osseous tissue.

In regard to osteogenesis, a mass of observations and experiences has been accumulated which in place of simplifying the questions has rendered them more complex. The problems of osteogenesis have passed through many stages—they were histological, then surgical, and finally have now become chemical. The authors believe it is useless for histologists to hash and re-hash their old disputes, or for the surgeon to continue experiments on the periosteum, bone grafts, or the osteogenesis of repair. Chemistry alone offers new facts in bone physiology and pathology.

Bone formation is regarded as a metaplasia of fibrous tissue first rendered embryonic, divided into the following phases:

(1) Fibrous tissue becomes œdematous and tends to revert to an embryonic type. (2) In the connective tissue thus formed there is a special pre-osseous infiltration. (3) This pre-osseous substance is impregnated with calcium salts and becomes hard. Bone is then formed. These points are then taken to explain all physiological and pathological changes in bone.

Any student of bone changes will enjoy reading these pages.

KELLOGG SPEED.

[1] LES PROBLÈMES DE LA PHYSIOLOGIE; NORMALE ET PATHOLOGIQUE DE L'OS. By R. Leriche and A. Policard. Paris: Masson et Cie, 1926.

AFTER an historical review of the subject of gastroscopy,[2] Rachet sets forth his reasons for the use of the straight gastroscope on a metal thread guide guarded by a bulbar tip. Gastroscopy is reserved for certain cases in which diagnosis can not be made by other clinical methods and is used to replace exploratory laparotomy. The methods of examination are given in detail.

Local anæsthesia preceded by a hypodermic injection of a sedative is always used. A 10 per cent solution of cocaine is painted on the pharynx just before the tube is inserted. The anæsthesia includes the pharyngeal fossæ, the posterior wall of the pharynx, the base of the tongue, and the superior orifice of the œsophagus. After the anæsthesia has obliterated the pharyngeal reflex the metal wire guide must be swallowed. The left lateral position is the best one for introducing the gastroscope but the knee chest position is the best for the progress of the instrument toward the stomach.

The problems of vision and orientation, once the stomach is entered, are then discussed, followed by descriptions of the normal gastric mucosa in the different segments of the stomach as seen through the gastroscope. Finally, the findings in the different pathological conditions of the stomach are discussed.

This small monograph covers completely and minutely the whole subject and becomes indispensable to anyone attempting this method of stomach examination.

KELLOGG SPEED.

A MONOGRAPH by Wassermann[3] based on years of clinical observation ably presents the newer clinical viewpoints concerning cardiac asthma. It is emphasized that asthmatic attacks occur in left heart as well as in right heart insufficiency. Functional insufficiency of the left ventricle produces asthma by affecting the arterial and the central nervous system.

WALTER NADLER.

THE joy of working in the virgin field of the wrist was Destot's. In 1898 he began his study of the complicated arrangement of the carpus and its injuries, and many articles and one small monograph came from his pen. A radiological study[4] was practically finished before his death, and now, after a too long period, has finally come from the press edited by some of his pupils.

About the carpus and its injuries very little is known by the average surgeon and still less by the practitioner. The subject is extremely complicated and although Destot spent 20 years in observation of this area and while he came to understand the fractures well, he apparently did not grasp completely the full pathology or radiology of the various dislocations. This volume is an important contribution

[2] LA GASTROSCOPIE; ÉTUDE CLINIQUE ET EXPÉRIMENTALE. By Docteur Jean Rachet. Paris: Gaston Doin & Cie, 1926.

[3] NEUE KLINISCHE GESICHTSPUNKTE ZUR LEHRE VOM ASTHMA CARDIALE. By Dr. Sigmund Wassermann. Berlin: Urban & Schwarzenberg, 1926.

[4] INJURIES OF THE WRIST; A RADIOLOGICAL STUDY. By the late Dr. Étienne Destot. Translated by F. R. B. Atkinson, M.D., C.M. (Edin.). New York: Paul B. Hoeber, 1926.

to the literature of the carpus, but it will be difficult for many readers easily to get information from it, as there is no up-to-date classification of the dislocations. The work on mechanism and pathology of fractures is excellent.

The illustrations could have been better described by words printed on the figures or by longer subscriptions aided by figures inserted on the drawing or halftone. The paragraphs on the rarer carpal fractures seem all too brief.

The last part of the book deals with fractures of the lower end of the radius and Colles' fracture, which becomes, according to the French idea, Pouteau's fracture. The author recommends the use of plaster-of-Paris splints for from 12 to 15 days in adults, and for from 15 to 20 days in epiphyseal separations of childhood. Rather small space is given to treatment of these fractures.

Dr. Atkinson deserves great credit for his translation from the French.

For the student of carpal injuries this book is invaluable; it will be referred to for years to come. For the average surgeon, only close and possibly repeated reading will result in an intelligent application of the material to his own cases.

KELLOGG SPEED.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

DISEASES OF CHILDREN; A SHORT INTRODUCTION TO THEIR STUDY. By Hector Charles Cameron, M.A., M.D. (Cantab.), F.R.C.P. (Lond.). New York; Oxford University Press, 1926.

RADIOTHERAPY IN RELATION TO GENERAL MEDICINE. By Francis Hernaman-Johnson, M.D. (Aberd.). New York: Oxford University Press, 1926.

SURGERY OF NEOPLASTIC DISEASES BY ELECTROTHERMIC METHODS. By George A. Wyeth, M.D. Preface by Howard A. Kelly, M.D. New York: Paul B. Hoeber, 1926.

THE SURGERY OF GASTRO-DUODENAL ULCERATION. By Charles A. Pannett, B.Sc., M.D. (Lond.), F.R.C.S. (Eng.). New York: Oxford University Press, 1926.

ELECTROTHERMIC METHODS (DESICCATION AND COAGULATION) IN THE TREATMENT OF NEOPLASTIC DISEASES; DESIGNED AS A PRACTICAL HANDBOOK OF SURGICAL ELECTROTHERAPY. By J. Douglas Morgan, B.A., M.D. Philadelphia: F. A. Davis Company, 1926.

BRAIN AND HEART; LECTURES ON PHYSIOLOGY. By Giulio Fano. Translated by Helen Ingleby. Foreword by Prof. E. H. Starling, C.M.G., M.D., D.Sc., F.R.S. New York: Oxford University Press, 1926.

CLÍNICA OBSTÉTRICA. By Dr. Guillermo Liepmann. 4th ed. Translated directly from the German by Dr. Víctor Conill y Montobbio. Barcelona: Salvat Editores, S.A., 1926.

PATHOLOGY AND TREATMENT OF THE INFLAMMATORY DISEASES OF THE NASAL ACCESSORY SINUSES. By Prof. Dr. M. Hajek. Translated and edited by Joseph D. Heitger, A.B., M.D., and French K. Hansel, M.D., M.S. 5th ed. vols. i and ii. St. Louis: The C. V. Mosby Company, 1926.

A PRACTICAL MEDICAL DICTIONARY. By Thomas Lathrop Stedman, A.M., M.D. 9th rev. ed. New York: William Wood and Company, 1926.

GOULD'S MEDICAL DICTIONARY. By George M. Gould, A.M., M.D. Edited by R. J. E. Scott, M.A., B.C.L., M.D. Philadelphia: P. Blakiston's Son & Company, 1926.

THE INFLAMMATORY AND TOXIC DISEASES OF BONE; A TEXT-BOOK FOR SENIOR STUDENTS. By R. Lawford Knaggs, M.C. (Cantab.), F.R.C.S. New York: William Wood and Company, 1926.

GOITER AND OTHER DISEASES OF THE THYROID GLAND. By Arnold S. Jackson, M.D. New York: Paul B. Hoeber, 1926.

ANALES DEL SANATORIO VALDES. vol. ii. Mexico: Bouligny & Schmidt Suer, 1926.

THE MODERN TREATMENT OF HEMORRHOIDS. By Joseph Franklin Montague, M.D., F.A.C.S. Foreword by Harlow Brooks, M.D., F.A.C.P. Philadelphia: J. B. Lippincott Co., 1926.

THE X-RAY IN EMBRYOLOGY AND OBSTETRICS. By W. A. Newman Dorland, A.M., M.D., F.A.C.S., and Maximilian John Hubeny, M.D., F.A.C.R., F.A.C.P. St. Paul: Bruce Publishing Company, 1926.

ORTHOPÆDIC SURGERY. By W. A. Cochrane, M.B., Ch.B., F.R.C.S.E. New York: William Wood & Company, 1926.

PHYSICAL THERAPY IN DISEASES OF THE EYE, EAR, NOSE, AND THROAT. With Chapters on Some Borderline Affections. By Abraham R. Hollender, M.D., and Maurice H. Cottle, M.D. New York: The Macmillan Company, 1926.

UEBER DIE STRUKTUR IN DEN CORPUS LUTEUM-ZELLEN DES MENSCHEN UND IHRE VERAENDERUNGEN WAEHREND DES MENSTRUATIONSZYKLUS UND BEI GRAVIDITAET. By J. J. Chydenius. Jena: Gustav Fischer, 1926.

THE DUODENAL TUBE AND ITS POSSIBILITIES. By Max Einhorn, M.D. 2d ed. Philadelphia: F. A. Davis Company, 1926.

AN ATLAS OF MIDWIFERY. By Comyns Berkeley, M.A., M.C., M.D. (Cantab.), F.R.C.P. (Lond.), M.R.C.S. (Eng.), and Georges M. Dupuy, M.D. New York: William Wood and Company, 1926.

THE TREATMENT OF FRACTURES WITH NOTE UPON A FEW COMMON DISLOCATIONS. By Charles Locke Scudder, A.B., Ph.B., M.D., F.A.C.S. 10th ed. rev. Philadelphia: W. R. Saunders, 1926.

MATERNAL MORTALITY; THE RISK OF DEATH IN CHILDBIRTH AND FROM ALL DISEASES CAUSED BY PREGNANCY AND CONFINEMENT. By Robert Morse Woodbury, Ph.D. Washington: Government Printing Office, 1926.

PLASTIC SURGERY OF THE HEAD, FACE, AND NECK. By H. Lyons Hunt, M.D., L.R.C.S. (Edin.). Philadelphia: Lea & Febiger, 1926.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. 5th series. New York: The Rockefeller Foundation, 1926.

A PRACTICE OF PHYSIOTHERAPY. By C. M. Sampson, M.D. The C. V. Mosby Company, 1926.

AMERICAN COLLEGE OF SURGEONS

SIR WILLIAM MACEWEN AND THE GLASGOW SCHOOL OF SURGERY[1]

By ARCHIBALD YOUNG
Regius Professor of Surgery in the University of Glasgow

IT is, indeed, a signal honor to be called upon to deliver this Oration, the purpose of which is to keep green in all our hearts the memory of that great man, who had so much to do with the origination of the movement that led to the foundation of the American College of Surgeons. I regret that my capacity for adequate fulfilment of the task is not equal to my desire to do it justice. If I fail in the attempt, it shall not be from lack of appreciation nor from overconfidence.

It is not the purpose of your annual oration, as I conceive it, that it should take the form of a mere panegyric on John B. Murphy, the man, or John B. Murphy, the surgeon; nor even that it should deal exclusively, or perhaps at all, with his great contributions to modern surgery. Were it the former, then, except as an entire outsider, I could not dare assume the task that has been given me.

It would indeed savor of presumption were I, who never saw your great surgical Hero, who never heard his voice, who had no near-hand experience of his personal influence, to speak to you of Murphy, the man, or even of Murphy, the teacher of his Art. If I knew him at all, it was most surely by his work. And yet, to one who has read, as I have done, that wonderful Memorial Oration which formed the first of this series, delivered by Sir Berkeley Moynihan in this City in 1920, it almost seems as if the great man stood forth so plainly that his lineaments, his speech, his methods of teaching, his habits of thought were familiar as those of an old acquaintance, a well tried friend (37).

Sir St. Clair Thomson, in an address delivered in the College of Physicians, Philadelphia, on June 14, 1919, entitled "A House-Surgeon's Memories of Joseph Lister" quoted from Browning the following lines; they are supposed to be spoken to a friend who had actually met, and talked with Shelley:

> And did you once see Shelley plain,
> And did he stop and speak to you,
> And did you speak to him again?
> How strange it seems and new! (45).

Thomson quoted the lines as suggesting to him the duty devolving on those, still surviving, who once had the great privilege of "seeing Lister plain," to put on record, for the benefit of those not so fortunate, such personal recollections and impressions as they can of that great man.

In that wonderful word picture of his, depicting John B. Murphy the center of an all-absorbing interest in his lecture theater, Moynihan has drawn a picture of Murphy as one of the greatest clinical teachers of the world, and has drawn it with a warmth of color that seems to me to stamp upon one's heart the very character of the man whom he paints. It must have helped many, as it has certainly helped me, to "see John B. Murphy plain."

But, if I may be permitted a few words about the great work of John B. Murphy, I should like to emphasize one aspect only of his almost priceless contributions to our common Art. Your earlier orators, Moynihan, William J. Mayo, Bastianelli, Crile, and Lane, as well as numerous other writers, have dwelt on most of the subjects in which Murphy's teaching has left its impress very deeply on the Science and Art of Surgery: Murphy's button, his intestinal clamps, his method of treatment of abscesses, his work on the treatment of ankylosis of the larger joints, on the production of artificial pneumothorax, on the repair of peripheral nerves. Perhaps none has dwelt sufficiently on the aspect of his work that has always appealed to me most, both from the point of view of its intrinsic value and as representing an advance of almost inestimable worth to the whole human race; I refer to Murphy's contribution to the proper understanding of the vital potentialities of the peritoneum, and to the treatment of peritonitis. May I present to you, in brief illustration, a picture of the state of things as they were, say, 25 to 30 years ago, in respect of the treatment of such a common surgical emergency as perforation of the stomach or of the duodenum, and contrast that picture with present day experience. A simple illustration is always worth a lot of theory.

[1] The John B. Murphy Oration delivered before the Clinical Congress of the American College of Surgeons, Montreal, October 25, 1926.

Almost 30 years ago, during my senior student days, and for several years later—during my terms of office as house surgeon, and after—a patient with such a perforation was regarded as almost doomed to speedy death. He or she reached hospital, it is true, often late, when toxæmia was far advanced; but whether early or late, what was the usual course of events? Operation was carried out, if carried out at all, with the patient in a state of profound collapse. It was nearly always a prolonged operation, in which the abdomen was laid freely open, the perforation was sought for, and sometimes found; in which much valuable time was consumed in the attempt to close the opening in the viscus, and more time was taken up in laboriously clearing away protective lymph. Most, if not all, of the abdominal viscera were turned out on the front of the abdomen, in the process; and thereafter a further period of time was consumed by the most painstaking irrigation of the whole peritoneal cavity with saline solution or weak antiseptic lotion. Then the patient, if still surviving,—and not a few died on the table, or were hurried back to bed with the operation only part completed,—was slowly and carefully stitched up again, and was returned to bed, in a state of profounder collapse than ever. What happened next? The patient was placed in bed, without any pillow, or with only a very low pillow, and the lower end of the bed was elevated, so as to still further depress the shoulders and head, and such restoratives as seemed appropriate were applied. The almost invariable sequel was that the pulse failed still further with greater or less rapidity, and presently became quite imperceptible; the whole body became covered with a clammy sweat, and death soon ended the scene. There was seldom any expectation of recovery. And I can well remember what a sensation was caused, in the hospital in which I was then a resident, when it was noised abroad that a certain patient seemed to show indications of possible recovery; and the greater sensation when such recovery became actually an accomplished fact.

Note the contrast today. The whole scene is changed. We look for recovery, not for death; and we are disappointed, not to say surprised, if recovery does not take place.

It is matter of common knowledge that such occurrences as perforation of stomach or duodenum are among the ordinary emergencies of present day surgical practice. They do not now depress us as they did before. I could cite numerous instances in illustration of the change in our experience. Take only one. It is sufficiently illustrative.

Quite recently, we received into my wards, in one day, 3 patients with duodenal perforation. All were bad cases. All three were operated on, as it happens, by my assistants. Though extremely ill on admission, not one of them ever looked like dying. All three made good recoveries. And this may be taken as typical of what we have come to regard as almost the normal.

To whom do we owe such a change? Very largely to the work and teaching of John B. Murphy, and his co-workers, but to Murphy chiefly. He it was who taught us to deal expeditiously with the initial lesion; to shorten the operation as much as possible; "quick in, quick out"; to disturb as little as possible the lymph that represents nature's attempt at protection; to abandon the laborious flushing of the peritoneum; to trust, rather, to its protective, recuperative powers; to provide, if required, simple drainage at the most dependent part; to make the pelvic peritoneum the most dependent part, by raising the patient in bed; to sit him up, in fact, and not the opposite; to call in the aid of gravity, so as to concentrate infection in the pelvis, the least dangerous part, and to lead it away from the highly absorbent and dangerous area under the diaphragm;—in fact, to do almost everything we had not been doing, and to do the very opposite of what we *had* been doing. He taught us to encourage the reversal of the lymph stream by administering, continuously or at short regular intervals, large quantities of normal saline, given *per rectum;* so to convert the peritoneum, from a mere absorbent, into a secreting or excreting organ, and encourage elimination.

Surely seldom has there been so complete a reversal of teaching and of practice! Today, after an operation for perforation of stomach or duodenum, it is quite a common experience to find, within 2 or 3 hours, a complete change in the whole clinical picture—pain gone, general comfort, the anxious facies replaced by a look of quiet content, the rapid, thready pulse replaced by a quiet, measured beat, normal or almost normal temperature; and instead of a patient writhing in agony, one who, reclining at ease or even sitting bolt upright against his pillows, is ready to give what help he can—and it is much—to counter the still potent possibilities of the disease.

It requires very little reflection to bring home to any one what a revolution the new principles have brought about. Those of us who lived and worked through the transition period realize it most; and, remember, it applies to all forms of peritoneal infective lesion. Think what a saving in human suffering; what a saving in human lives!

Even as we assess Lister's great discovery, to some extent, in terms of its saving in human suffering and human life, so, also, should we appraise the value of John B. Murphy's teaching in respect of peritonitis and its treatment by surgical means. For this great life-saving work, alone, he deserves well of all humanity, and we, his humble disciples, do homage to his great memory.

Having paid, I hope in no perfunctory manner, my tribute to the memory of one great man of our day and generation, I crave your attention for a little longer while I endeavor to appraise for you the life and work of another great man, who, like John B. Murphy, shall surely have a prominent and honorable place in that "Great Procession" of which Sir Berkeley Moynihan spoke in his Memorial Oration in 1920. I refer to my great predecessor in the Regius Chair of Surgery in the University of Glasgow, Sir William Macewen. I would that I could hope to enable this great audience to "See Macewen plain." If, in some measure, I am able to succeed in this endeavor I shall be happy indeed.

I am going to ask your permission, however, to say a little about the School of Surgery in Glasgow, where Macewen's life work was done.

In connection with what I have termed the Glasgow School of Surgery, I propose to speak almost exclusively of the course of surgical development and teaching in Glasgow during the period which has elapsed since the institution of the Regius Chair of Surgery in the University of Glasgow in 1815, i.e., 111 years ago, and indeed, to speak of it, as one naturally does, in terms of the successive occupants of the Chair. That is not to say that, apart from the Regius Chair of Surgery at the University, surgery in Glasgow did not exist. Indeed, it would be far from the truth to say, or to imply, any such thing. But it is a convenient way of expressing, in terms of the famous men who have, in their day and generation, been called to that high office, the general progress of events surgical during the period under review. But you will pardon me, if, for a few moments, I take you even further back, and make brief reference to one whose name we in Glasgow cherish still, though he has been gathered to his fathers now for more than 300 years; one, too, whose name and fame are probably as well known to many of you as to myself—Maister Peter Lowe.

The Glasgow School of Surgery

Maister Peter Lowe

In the spring of the year 1598, there returned from France, to Glasgow, probably his native city, Maister Peter Lowe. This great man of his day, had seen service as "Chirurgian major to the Spanish Regiments at Paris," had followed the "French King, my Master in the warres 6 yeeres," where he "tooke commoditie to practise all points and operations of Chirurgerie." He was a contemporary, possibly an acquaintance, of Ambroise Paré, and, indeed, in his published works and in his teaching, he made use of not a few of Paré's illustrations, and adopted and recommended Paré's use of the ligature. Like Paré, though probably by other means, he escaped the perils of the Massacre of St. Bartholomew.

Settling in Glasgow, Maister Peter Lowe soon became so impressed with the unsatisfactory state of things medical and surgical there that he set himself to procure from the King such powers as were necessary to put them right. He sought to obtain from King James the Sixth a charter which should enable him to found some statutory body or College, after the fashion of his own College in Paris. He must surely have had remarkably persuasive powers, or very direct access to the throne, for, within a year and a half of his return to Glasgow, the charter was in his possession, "Written to the Privie Seil, Penult November, 1599." Under this charter was founded, in the year 1602,—the delay of a little over two years is explained by the fact that Lowe had gone to France with the embassy of the Duke of Lennox—the Faculty (now the Royal Faculty) of Physicians and Surgeons of Glasgow. Amongst other provisions of the charter, power was given to Maister Peter Lowe, and a Mr. Robert Hamilton, and their successors, to "summond and convene" "all personis professing or using the said airt of Chirurgie, to examine thame upon thair literature, knawledge and practize: gif they be fund wordie to admit, allow and approve thame, give thame testimonia according to the airt and knawledge." Other provisions were concerned with the proper regulation of the sale of drugs, the supervision of the sale of poisons, and with certain medico-legal functions. The seventh provision of the charter was to the effect that "the saidis visitouris, with thair bretherene and successouris, sall convene every first Mononday of ilk moneth at sum convenient place, to visite and give counsell to pure disaisit folkis gratis:" The Royal Faculty founded under this Charter still exists; still (though now in association with the Royal Colleges in Edinburgh) grants licences to practice, after examinations held sometimes in Glasgow, sometimes in Edinburgh; still grants higher qualifications in medicine and in surgery; still appoints annually an inspector of drugs. And, at its statutory monthly meetings, the minutes

regularly end with the words—"The poor were visited gratis, and the Faculty adjourned."

It is necessary to remind you, that, at the period when the Faculty of Physicians and Surgeons was founded thus by Royal Charter, the University of Glasgow had been in existence already for 150 years, but it concerned itself not at all with either the teaching of medicine or surgery. Nor had it any part in the regulation or examining of those who practiced medicine or surgery. It was not till a little over a hundred years later that there was founded in the University a Chair of Medicine (1712); and still another hundred years were to elapse ere was founded the Regius Chair of Surgery.

So that Maister Peter Lowe, the founder of the Royal Faculty, is surely worthy of honorable mention in any account of the development of surgery in Glasgow.

It will surely be of interest to Fellows of the American College of Surgeons, whose aims, in the foundation of the College 13 years ago, were so largely concerned with the higher standards that they wished to see maintained, in education, in ethics, in honesty, industry, and in all that connotes humane learning and experience in the wider developments of surgery; who set themselves from the first against all ignorant pretenders and quacks, in whatever form, and however speciously disguised; who have had before them ever the maintenance of the very loftiest ideals in the training of those who shall practice their common Art, and the preservation of the noblest standards in our profession; to know how, over 300 hundred years ago, Maister Peter Lowe was prompted to seek his famous charter from very similar ideals, and on like grounds.

The late Dr. James Finlayson, in his *Account of the Life and Works of Maister Peter Lowe* (8), refers to the fact that Lowe's writings abound with references to all sorts of "abusers," "deceivers," "ignorants," "simple Barbers," "and other ignorant fellowes," "Empirickes" &c., and he quotes from the preface to the second edition of Lowe's *Chyrurgerie*, dated 1612, the following:—

> It pleased his Sacred Maiestie to heare my complaint about some fowerteene yeeres agoe upon certaine abusers of our Art, of diuers sorts and ranks of people, whereof we haue good store, and all things fayling, unthrifts, and Idle people doe commonly meddle themselues with our Art, who ordinarily doe passe without either tryall or punishment. The matter being considered, and the abuse waighed by his Maiestie and Honourable councell, thought not to bee tolerated, for the which I got a priuiledge under his highnes priuie seale, to try and examine all men upon the Art of Chirurgerie, to discharge, & allow in the West parts of Scotland, who were worthy, or unworthy, to professe the ame.

Were it possible for us to throw ourselves back a little over three hundred years, I am certain that we should all be prepared to support Maister Peter Lowe in his praiseworthy efforts to raise and to uphold the status of our common Profession.

But I would not have you to suppose that Maister Peter Lowe's claim to honor rests exclusively, or even mainly, on the stand he took in this direction. As Finlayson says:

> Peter Lowe's reputation, beyond the neighborhood of Glasgow, rests chiefly on his work on *Chirurgerie* (1597). This seems to have been the first original systematic treatise on the "Whole Course of Chirurgerie" published in the English Language, or indeed in any language in this country. . . . Various partial treatises, as on syphilis and gunshot wounds, had, indeed, been published in English, and Peter Lowe himself had issued, during the previous year, a little book on the *Spanish Sicknes;* but his new work aimed at going over the whole of Surgery, which was then rising into great importance as a branch of the healing art, so far distinct from medicine.

Further, Lowe published, bound up with all the editions of his *Chirurgerie*, what was the first English translation of any of the Hippocratic writings: *The Presages of Diuine Hippocrates.*

This is not the place, nor is there time, to refer at length, or in detail, to the character of Lowe's published works, but it may suffice to say that they were well informed, carefully put together, and that, even today, they are not without interest.

In his *Chirurgerie* he deals with aneurism, gunshot wounds, pyæmia, hernia, the treatment of dropsy, the use of the ligature, certain eye diseases, diseases of the ear and teeth, &c.

One special reference to Lowe's writing I would wish to make, particularly in view of the criticism sometimes passed upon his work, that it was not founded on personal observation and deduction of his own, but represented in great measure accepted authority. The reference has this added interest that it stands as one of the very earliest recognitions of the part played by *contre coup*, in cranial injury; and enables me to link Lowe's work with that which was the chief achievement of him who is the main subject of this oration, Sir William Macewen. Let the following extract from Lowe's *Chirurgerie* tell its own tale, and speak for itself:

> "The fift kind of fracture is called counterclift, that is, when the cleft of the bone is in the part opposite to the sore, and of all fractures this is the worst, and deceaueth most the Chirurgion . . . . I haue knowne sundry dye in this case, chiefly at the battle of Sandlis in Fraunce a valiant Captaine of Paris, who had a stroake on the right parietary, who, notwithstanding of all handling by skilfull Chyrurgions dyed within 20 days, at which time his Cranium was opened, and there was found great quantity of blood under the left parietarie, with a cleft in the same. (Lib. vi, chap. II, p. 314.)

Maister Peter Lowe was born somewhere about the year 1550. This date is probably fairly accurately determined. The date of his death is not so definitely known, but it seems probable that it was between the years 1612 and 1614. His tomb is in the churchyard of the Glasgow Cathedral, and, since 1834, has been the property of the Faculty of Physicians and Surgeons. It is marked by a simple memorial stone. The inscription on the tombstone is quaint and well worthy of quotation. I therefore reproduce it here in full:—

1612.
M.
P. L.

IOHN. LOW IAMES. LOW

DOCTOR PETER LOW

The Founder of the Faculty of Physicians and Surgeons
Stay.Passenger.And.View.This.Stone
For.Under.It.Lyis.Such.A.One
Who.Cured.Many.Whill.He.Lieved
Soe.Gracious.He.Noe.Man.Grieved
Yea.When.His.Phisicks.Force.Oft.Failed
His.Plesant.Purpose.Then.Prevailed
For.Of.His.God.HE.Got.The.Grace
To.Live.In.Mirth.And.Die.In.Peace
Heavin.Hes.His.Soul.His.Corps.This.Stone
Sigh.Passinger.And.Soe.Be.Gone

AH ME I GRAVELL AM AND DUST
AND TO THE GRAVE DESHEND I MUST
O PAINTED PEACE OF LIVEING CLAY
MAN BE NOT PROUD OF THY SHORT DAY

THE REGIUS CHAIR OF SURGERY IN THE UNIVERSITY OF GLASGOW

The Regius Chair of Surgery in the University of Glasgow was instituted in the year 1815, so that it has been in existence now for 111 years. In the course of this period there have been, before myself, five occupants of the Chair.

In my inaugural address, at the opening of the winter session, October 15, 1924 (48), I dealt with some of the Traditions of the Chair to which I had just been appointed, making brief reference to the life and work of my predecessors. I wish to tell you a little about them; referring, at greater length, to my immediate predecessor, Sir William Macewen.

All were distinguished men, who helped, each in varying degree, to establish the high credit of Surgery, and of Surgical Teaching in Glasgow—and in Scotland.

JOHN BURNS, M.D. (1815–1849)

The first Regius Professor was John Burns, M.D. He was appointed in 1815, and held office till 1849, *i.e.*, 34 years. Judged by our standards, I fancy you will think his period of tenure too long, and probably you are right in thinking so, but, at any rate, he acquitted himself with great distinction in his day.

His treatise on *The Principles of Surgery*, of which the first volume appeared in 1829, will bear reading today, for more than its purely literary interest. If I refer to the first volume, I do so because it is the one which I have chiefly read, and you will find, in quite a number of directions, how accurate and original are many of the observations of its author: on such subjects, for example, as the phenomena of inflammation. He describes these phenomena in considerable detail, from the clinical aspect, illustrating his descriptions with reference to different tissues, and also reports, at some length, the results of experimental research, e.g., regarding the effects of experimental irritation of the liver of a frog. Many of the observations which he made are of much interest today. Or take his classification and description of tumors, and read his suggestive discussion of their possible methods of origin, and you will find not a little that may afford help in our research today into the problem of their causation.

His chapters on hæmorrhage, wounds of arteries, formation of false aneurisms, on true aneurism, on aneurismal varix, and varicose aneurism, leave little to be added to in accuracy of description, even in the light of present-day knowledge. Burns writes throughout with clearness, without any sign of over-assurance, but with the style and force of a master of his subject, and with the mark of one whose whole heart was in his work.

It is to me a very notable and delightful thing to find that he dedicates his treatise to one of his colleagues on the Senate, James Jeffray, M.D., then the professor of anatomy. Burns inscribes his treatise to Jeffray, "as a mark of respect and esteem,"—evincing a fine spirit between colleagues. Jeffray was appointed professor of anatomy in 1790, and held office till 1848, i.e., 58 years—surely a long term of office. The terms of office of the two, Burns and Jeffray, ended within two years of each other.

Prior to his appointment to the Regius Chair of Surgery, Burns had taught anatomy, surgery, and midwifery at a private School of Anatomy in the City. Later, he taught anatomy and surgery in the Anderson's College in Glasgow. It is of interest to relate, also, that Burns had made a reputation for himself, quite apart from anatomy and surgery, as a writer on midwifery. His *Principles of Midwifery*, published in London in 1809, went through ten editions, and was translated into other languages.

Dr. Alexander Duncan, in his *Memorials of the Faculty of Physicians and Surgeons, Glasgow* (5), says: "As a teacher of anatomy, he had earned the reputation of being an able expounder of that science. This reputation went with him to the chair of surgery, and, added to that which he further acquired, of being, through his works on the subject, the most popular expounder of midwifery in his day, was the means of attracting students from a distance."

But there is one direction in which Burns achieved special distinction. On his appointment as a Surgeon to the Royal Infirmary, he recognized the need of teaching his subject clinically in the wards. He accordingly presented a memorial to the managers of the Infirmary, in 1797, in which he pointed out the advantages of this method of teaching, and requested permission to give a course of clinical lectures in the wards of the hospital, during the ensuing session. The necessary permission was granted, and, from that time on, though with occasional intermissions, clinical lectures continued to be given in the Infirmary. This is not the place to refer to the somewhat varied and at first fitful history of the development of clinical teaching in Glasgow. Suffice it to say that John Burns has the distinction of having been the first lecturer on clinical surgery in Glasgow.

Burns was a man of European reputation, not only, as we have seen, in surgery, but also in midwifery. He was a Fellow of the Royal Society and a member of the Institute of France. His portrait, by Graham Gilbert, is in the possession of the University of Glasgow.

Burns was lost in the wreck of the Orion in 1849.

JAMES A. LAWRIE, M.D. (1850–1859)

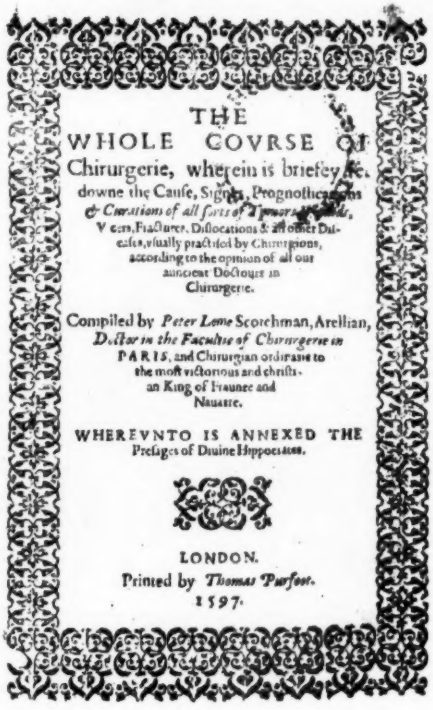
James A. Lawrie, M.D., was the second Regius Professor of Surgery in the University of Glasgow. He held office for only 10 years, and perhaps it would be just to say that his reputation was in the main a local one. Such publications as he made were, I think, purely in the pages of the *Glasgow Medical Journal*, one of the pioneers of provincial medical journalism. Lawrie was, in fact, for some time editor of this journal. Prior to his appointment to the Regius Chair in the University, he had held office as professor of surgery in Anderson's College, to which he was appointed in 1829. He was also an active member, and indeed one of the promoters, of the Medico-Chirurgical Society of Glasgow, which was constituted in 1844 as a rival of the older, and, as many of its members thought, too conservative and un-enterprising Society, known as the Glasgow Medical Society, which dated its origin back to 1814.

One would not be doing simple justice, however, to the memory of Lawrie, did one not bear witness to the very important part he played in one direction. Indeed, the reference that I feel bound to make furnishes, to my mind, a somewhat unusual instance of the far-reaching effect that carefully compiled statistics may have in affecting teaching and practice. Lawrie's statistics, and his personal views, based on these statistics, had reference to the treatment of fractures of the skull, and it seems to be the fact that they led, directly or indirectly, to the reversal to what had come to be almost generally accepted teaching on this subject, in Great Britain at least.

The tale is worth the telling, as illustrating how, in one important direction, at least, Lawrie impressed his views and teaching on surgical opinion and practice. It has the added interest that it was in a branch of surgery that Lawrie's great successor of over 30 years later, Sir William Macewen, was to develop in such remarkable degree, viz., in the matter of cranial surgery.

The history of the development of the surgery of the skull and brain, as you are doubtless aware, has been one of curious variation in rate of growth; marked by a degree of advance and enterprise in the very earliest periods that seems difficult to realize, and later by a very long period of comparative stagnation. Even when, once more, the march of progress seemed to have been resumed, it was only to lapse again, and to fall almost into disrepute. Let me remind you of some of the salient landmarks in its early history, and lead you on to the later developments, in which Lawrie's work played a part.

Operations on the skull, as you are aware, and as Sir Berkeley Moynihan reminded you, in his John B. Murphy Oration, in 1920, were known in the earliest periods of history. Hippocrates (360 B.C), Celsus (A.D. 17), and other surgeons of their respective periods down the centuries, used the trephine or trepan. This is well known, and there are abundant records, pictorial and descriptive, of many of the instruments they employed. Many of these I figured in a paper delivered in 1924. It is remarkable how close a resemblance many of them bear —trephines, trepans, saws, raspatories, etc. —to the instruments we use today. But more remarkable even than the considerable state of development of cranial surgery in the Hippocratic times, is it to realize that, before the dawn of history, purposeful trepanning was occasionally carried out as a therapeutic measure.



THE
WHOLE COVRSE OF
Chirurgerie, wherein is briefely &c.
downe the Cauſe, Signes, Prognoſtications
& Curations of all ſorts of Vlcers,
Vlcers, Fractures, Diſlocations & all other Diſeaſes, vſually practiſed by Chirurgions,
according to the opinion of all our
auncient Doctours in
Chirurgerie.

Compiled by *Peter Lowe* Scotchman, Arellian,
Doctor in the Faculte of Chirurgerie in
PARIS, and Chirurgian ordinaire to
the moſt victorious and chriſt-
an King of Fraunce and
Nauarre.

WHEREVNTO IS ANNEXED THE
Preſages of Diuine Hippocrates.

LONDON.
Printed by *Thomas Purfoot.*
1597.

Title page of first edition of the *Chirurgerie;* from the copy in the Library of the Royal Medical and Chirurgical Society of London.

Lucas Championnière, in his work on *Les Origines de la Trépanation Décompressive*, depicts a skull from the Neolithic period, which shows a large, smoothly rounded orifice in the left parieto-occipital region, which is almost certainly relic of a therapeutic trephining. Had it been done at the present time it could hardly have been bettered, and remember, it must have been done with flint instruments.

And, in skulls collected from the burying grounds of the Incas of Peru, and from caves and tumuli in France, some certainly of the Stone Age, he found evidences of the operation having been performed with some frequency. He was convinced, not only of the operation having been carried out, but also that the appearances went to prove that the patients must have survived operation for long periods.

It has been recognized, indeed, that prehistoric craniectomies were not uncommon, and some authorities have gone so far as to suggest that they

Peter Lowe's tomb in the churchyard of Glasgow Cathedral.

had some religious significance. Victor Horsley, however, after making a careful examination of that great collection—yet so badly housed withal, —in the Broca Museum, Paris, in 1887, concluded "(1) that the operative openings were always over the site of representation of movement, on the cerebral cortex; (2) that the patients had probably been suffering from Jacksonian epilepsy; (3) that the operation would gain a certain reputation for the cure of convulsions generally; and (4) that at least some of the operations, e.g., for depressed fractures, would result in cure" (2).

The writings of Hippocrates, and others of his times, and during the centuries immediately following, show that even then trephining was based on a knowledge much more advanced than one might have expected. It seems that Hippocrates trephined for the purpose of decompression, to relieve inflammation, for the evacuation of pus and blood, and for the extraction of foreign bodies. His writings show, also, that he recognized the contralateral distribution of convulsions and paralyses following certain head injuries. It is even on record that he recommended the use of the trephine for the treatment of blindness occurring without any visible disease of the eye. This would seem to be, surely, the very earliest known evidence of the recognition of the value of

decompressive trephining for the relief of what we now know as optic neuritis, and its consequent blindness.

I mention all this to emphasize what I have to say regarding the part played by Lawrie, over 2000 years later, in helping to re-establish the practice of what one might call "preventive trephining" in cases of fracture of the skull with depression of bone.

For you must not suppose that even the level of the Hippocratic teaching in this connection was adhered to and sustained in the many centuries that followed. During these centuries following upon the times of Hippocrates and Celsus, trephining or trepanning had a strangely changing and chequered history.

The operation continued to be practiced, here and there, and by many surgeons, but there were periods when it almost seemed as if it were to be abandoned. References to it are to be found in the writings of Roger of Salerno (1170 A.D.), Walter of Agilon (middle of thirteenth century), Ambroise Paré (1560 A.D.), Andreas a Cruce (1573 A.D.), Fabricius Hildanus (1560–1634 A.D.), and so on. But it was not till the time of Percival Pott (1713–1788 A.D.), that, in Britain at least, the rule of practice was established—"That, in every case of fracture of the skull, with depression, the skull should be perforated, and the depressed fragment of bone either raised to its proper level, or entirely removed."

This rule of practice laid down by Percival Pott, however, did not hold its own far into the succeeding century. Opinion became so changed, in fact, that Pott's teaching fell into disrepute and was very generally rejected in Great Britain. And it was not only in Britain that this was so. Désault of Paris, for example, writing about 1809 A.D., maintained—"that, in view of the numerous unfortunate results of the operation of trephining, or trepanning, its practice was reduced down to only trephining in *compound* fractures of the skull, and to depressed fractures *with symptoms*" (the italics are mine. A. Y.). Perhaps one of the most extreme statements, against the whole practice of trephining, made about this period was that of Pirrie, who, writing in 1840 A.D., said: "These fractures, and the numerous inventions of instruments for cutting the skull, are sad monuments of the surgery of past ages."

And so, for about half a century, Percival Pott's teaching on the subject was practically set aside. Let us see what was the cause, or at least the main cause of this reaction—this set back—in surgical opinion and teaching. It seems to be pretty clearly proved that to Abernethy—himself a notable surgeon of his day—must be ascribed the main credit or discredit, of upsetting the teaching of Percival Pott. Writing about the year 1811 A.D., Abernethy expounded the view that the operation might often be dispensed with, even in fractures of the skull where depression of bone was definitely known to be present. In support of his view, he related five cases of fracture of the skull, with depression, which he had had under his care and observation, within 12 months, in St. Bartholomew's Hospital, and which terminated favorably, although no operation had been performed.

It seems that the account of Abernethy's five cases, and the authority of his great name, produced upon professional opinion in Britain so profound an effect that, according to Francis Adams, who refers to the subject in his treatise on *The Genuine Works of Hippocrates* "it became the established rule of practice in British Surgery never to interfere, in cases of fracture of the skull, unless with the view of removing urgent symptoms." But this reactionary teaching was not long to hold the field, and Francis Adams ascribes a notable place, in the overthrow of such a rule of practice, to what he terms "the elaborate and trustworthy statistics, published in 1844, A.D. by Dr. Lawrie, of Glasgow." These statistics were compiled from the records of the Glasgow Infirmary,—now the Glasgow Royal Infirmary. Adams discusses these statistics at some considerable length, but it is sufficient, for my present purpose, to quote only Lawrie's conclusion, which was as follows: "From what we have said, it will appear that we coincide with those who, in using the trephine, in cases of compound fracture of the skull, look more to the state of the bone than to the general symptoms, and who employ it more as a preventive of inflammation, and its consequences, than as a cure for urgent symptoms, the immediate result of the accident" (14).

This then was the Lawrie who, a few years later, became Regius Professor of Surgery in the University. If he never accomplished more than this, by which he helped to turn the whole direction of surgical teaching, in respect of the operative treatment of fractures of the skull, he had not lived in vain. Glasgow remembers him with pride.

JOSEPH LISTER, M.D., F.R.S., ETC. (1860–1869)

Then came Lister. Joseph Lister was appointed to the Chair in the year 1860, and held office for 9 years, when he went to occupy the corresponding Chair in the University of Edinburgh. When that is said, almost all has been said that need be said.

Every one is aware of what his work has done both for the Art and for the Science of Surgery, and the fact that Lister's epoch-making investigations, and his initial application of these investigations to the practical technique of surgical treatment were begun and in great measure brought to fruition in Glasgow, during his tenure of office there, can surely never cease to be a matter of infinite pride to all of the alumni of our University.

Lister, perhaps the foremost benefactor of the human race, applied to surgical practice, with unerring deduction and judgment, the principles that had been suggested to his mind by the laborious and brilliant observations of his co-worker and friend, Pasteur.

And even though others before him had had at least some inklings of the truth; like Semmelweis, who, in 1847, traced puerperal fever to infection, and showed how it could be prevented, incurring not a little opposition and even obloquy thereby, from those chiefly whose work was to benefit so largely from his teaching; or, like Lémaire who, in 1863, in a treatise on carbolic acid, advocated its use for the destruction of germs in wounds; or like Bottini, who, in 1866, advocated the employment of carbolic acid in suppurating wounds, because he was of the opinion that germs were the active agents of suppuration; it yet remains none the less true that Lister's application to the practical problems of surgery, particularly in respect of the healing of wounds, of the scientific results of Pasteur, by which he deduced the general laws of antisepsis, has been the very foundation of modern surgery.

It required the master mind of Lister to solve the riddle; to work out fully the problem of the prevention of wound infection, which had baffled surgeons up to his time; to show how nature could be entrusted with repair, so long as infective germs were excluded from a wound, or were counteracted by suitable antiseptic agents. Lister did more than any man to free surgery and surgical achievement from the bonds that shackled opportunity, and that limited its advance in almost every direction. As Virchow said of Morgagni, so let us say of Lister: "Ihm sei die Ehre" (To him be the honor).

I may be allowed to quote the words employed by your illustrious compatriot, Mr. Bayard, when, as Ambassador in London, proposing the toast of Lister's health at a banquet of the Royal Society, he exclaimed:

"My Lord, it is not a profession, it is not a Nation, it is Humanity itself which, with uncovered head, salutes you."

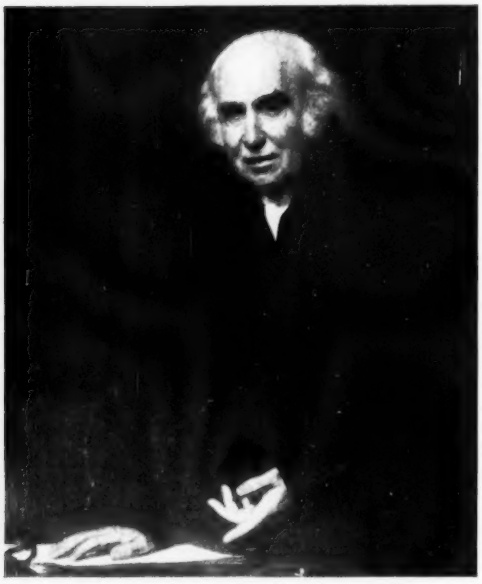
Maister Peter Lowe.

What I may be permitted to call "The Lister Tradition" is more than sufficient to render the Regius Chair of Surgery in the University of Glasgow illustrious for all time.

On the rising ground on which the University buildings are reared, and in a proximity to each other that seems significant of much, have been placed memorials to two of Glasgow's greatest men—Lord Kelvin and Lord Lister. Who shall attempt to estimate or to appraise the relative greatness of each? We do not honor Lister the less, I am certain, when we place him alongside that other great man, whose mathematical genius, and whose deductive reasoning in the realms of pure and applied mathematics, remain one of the wonders of our time.

Viewing surgery purely as an Art, Lister may not have been the greatest surgeon of his time. Indeed, it seems to be generally admitted that a good many of his contemporaries surpassed him in mere manual dexterity, and in the technique of operative work. But, viewing surgery as a science, Lister was probably the greatest surgeon of all times.

Only once did I see Lister; only once hear him speak—in his later years. To that occasion I shall have to allude later on, in speaking of Macewen. I mention it now merely to say that one of the memories which I cherish is that of shaking hands, as I did on the occasion referred to, with the immortal Lister.



John Burns, first Regius Professor of Surgery, Glasgow University.

James A. Lawrie, second Regius Professor of Surgery Glasgow University.

SIR GEORGE H. B. MACLEOD, M.D., LL.D., ETC.
(1869–1892)

Lister's immediate successor was Sir George H. B. Macleod, who occupied the Chair from 1869 to 1892. He was not only a notable and able surgeon; he was one of the ablest teachers of surgery that I have known. His teaching was, of course, of the didactic type. It had not the originality of thought either of his immediate predecessor or of his immediate successor. Probably it did not stimulate, as theirs did, originality of thought in his disciples and students.

His surgery, of course, was not the surgery of today, and much of his teaching would not be accepted today. His teaching was dogmatic, largely based on authority, and on accepted, or supposedly accepted, and fixed, doctrine. But Macleod certainly had the gift, in almost unique degree, of imparting to his students the knowledge that he wished to impart. He had an orderly, methodical mind; was possessed of great powers of description, and of illustration, and he had a habit of great industry. His lecture room was always crowded; his clinical lectures were enthusiastically attended.

His distinguished, commanding presence, his fine head, his courtly manners, live still in the minds of his students, of whom many still survive. It was my lot to begin my studies at the University three years before his death, just in time, that is, to see a little of his work, to hear something of his teaching, to observe for myself his power of imparting his views. No doubt, he was already considerably past his best, but even the short experience that I had of his teaching left a vivid impression on my mind; and this although, already, his younger and more vigorous and original rival, who was so soon to be his successor in the Chair, had lit a beacon in the east of Glasgow that outshone the brilliance of that in the west.

During the tenure of the Chair by Sir George Macleod, its honor and prestige were fully maintained.

SIR WILLIAM MACEWEN, M.D., LL.D., F.R.S., ETC.
(1892–1924)

The fifth Regius Professor of Surgery in Glasgow was Macewen. Appointed to the Chair in 1892, he occupied it until his death, 32 years later.

Macewen, after Lister, was undoubtedly the most distinguished and most famous of the occupants of the Chair. His lamented death is, perhaps, too recent to allow an accurate estimate of his life and work; or to determine exactly what place he should occupy in the history of surgery. Even a provisional estimate of his influence both on the Art and on the Science of Surgery is dif-

Joseph Lister, third Regius Professor of Surgery, Glasgow University.

George H. B. Macleod, fourth Regius Professor of Surgery, Glasgow University.

ficult. But this, at least, can be said, without hesitation, that, in that "Great Procession" spoken of by Moynihan, his will be, certainly, one of the greatest, one of the most outstanding figures.

I have dealt, at considerable length—I trust not uninterestingly—with the lives and the work of Macewen's great predecessors in the Regius Chair of Surgery in Glasgow; also with their pioneer ancestor Maister Peter Lowe. I have taken this method of suggesting to you, in terms of the most prominent actors in the drama, the development, through the years, of the school of surgery in Glasgow. What I have told you of these men has been largely culled from history; and presented to you by one who has perhaps no more aptitude to assess the verdict of history upon them than many of yourselves; who has, indeed, perhaps the defect of such bias as naturally springs from his personal attachment to the same School, and his jealousy for its prestige. Such estimate as I have given, at any rate—except, to a slight extent, in the case of Sir George Macleod—has not the authority of one having had a personal relationship with him of whom he speaks or writes; the "personal touch" is quite absent.

Of what I have to say regarding Sir William Macewen such complaint can not be made. If there is anything of value, in enabling an accurate estimate of the man and his work, in the "personal touch," then I may be said to have that necessary qualification; whatever other qualifications may be lacking. I was a member of his Class of Systematic Surgery and of his Classes of Clinical Surgery. I was his house surgeon, and later, for a period, his assistant. So that I was brought fairly closely into association with him. My hope, therefore, is that from such personal association as I was privileged to have with him, I may be able to succeed in making you "see Macewen plain." If, in a measure, I am able to achieve my object in that respect: to present to you a word-picture of the life and work of that great man, which shall have the effect of enabling you to form some idea of the man and his work, as those saw him who knew him best, I shall be amply rewarded.

First of all, it is best to be quite frank, and to tell you that what I have to say about Macewen is based upon, and indeed, largely embodies the substance of, the Oration which it was at once my duty and my privilege to deliver, on June 23 last, at the Service of Commemoration of Benefactors in the University of Glasgow. We have commemoration biennially, on the occasion of the Honorary Graduation Ceremony for the year. This year the University Court decided that the subject of commemoration should be Sir William Macewen. I have had the temerity to present to you today the substance of what I said

William Macewen, fifth Regius Professor of Surgery, Glasgow University.

on that occasion. I do so, however, not on my own authority. For the choice of subject you must ascribe some part of the blame, if blame there be, to your Director-General, Dr. Franklin Martin (50).

I do not propose to say anything of a purely biographical nature of Macewen, nor to attempt to separate his Life from his Work. To my mind, Macewen's Life and Macewen's Work were synonymous. If his life was not his work, at any rate his work was his life. His whole life was work, and purposeful work. One often hears the phrase "putting in the time," or "passing the time." There is the French phrase *pour passer le temps*. Macewen could never have used such a phrase of himself. I could not imagine Macewen ever doing anything *pour passer le temps*. I think he must have been impressed, as so many of the world's greatest men have been, with the very meager store of knowledge so far wrested from the Book of Nature, compared with the vast realm of the still unknown, and have been actuated throughout his life by the determination, perhaps hardly formulated in his mind, but none the less implicit in his conduct, to devote his great powers unceasingly and without rest to making advance in orderly fashion along the line of progress; to adding his share to the book of discovery.

I have been perusing, recently, a list of Macewen's published works. It is a remarkable list, though by no means complete. It comprises more than seventy separate contributions to the literature of surgery. The greater part of the list is made up of papers and monographs of such importance, and representing such a mass of scientific research, as might have occupied the time and the energy of several earnest workers.

In addition to the many shorter papers, almost all with their own intrinsic value, there are the longer papers, addresses, and lectures before learned and scientific societies, all of importance, and most of them striking some original note, or suggesting some new line of research. Nor does this end the list; there remain the larger works, which, by their inherent merit, have established themselves as standard presentations of the subjects with which they deal.

Macewen's treatise on *Pyogenic Diseases of the Brain and Spinal Cord*, and his works on *Osteotomy* and on *The Growth of Bone* rank already as classics. His *Atlas of Head Sections* is a contribution to the surgical anatomy of the skull and brain which stands out as a permanent addition to scientific knowledge. The cost of its production must have made it almost as notable a failure financially as it was certainly almost priceless as a contribution to anatomy and surgery. It must have cost infinite time and infinite labor to produce, such as would have taxed, almost beyond limits, the capabilities of most men. But Macewen, as the saying goes, "took it in his stride," and the *Atlas* appeared in the same year as saw the publication of his great work on *Pyogenic Diseases of the Brain and Spinal Cord*. Both of these were published only 5 years after the great address on *The Surgery of the Brain and Spinal Cord*, which he gave before the British Medical Association, in Glasgow, in 1888. These 5 years must surely have been full years for Macewen, and for those who worked with him; for even these publications did not represent all his interests during that period. Within the same period he found time to publish a notable paper on the surgical treatment of aneurism: "On Aneurysm: Its Cure by Inducing the Formation of White Thrombi within the Sac" (26); to contribute, to Christopher Heath's *Dictionary of Practical Surgery*, articles on "Diagnosis of Head Injuries; Fracture of the Skull; Encephalitis, Meningitis, and Abscess of the Brain; Compression of the Brain; Hernia of the Brain; Osteotomy; Grafting; Tracheal Catheterism" (25); and to lay before the Medico-Chirurgical Society of Glasgow, in his capacity of President, an exhaustive contribution to a discussion on anæsthetics (27). In this last contribution he embodied his own considered conclusions on the subject of anæsthesia, and discussed the conflicting claims of the advocates of chloroform, on the one hand, and of ether, on the other. He described the dangers of general anæsthetics, and laid down, definitely and explicitly,

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his own views as to how these dangers might best be avoided or counteracted. The views he expressed then remained with him for the rest of his life, and the instruction which he gave to students on the subject of anæsthetics may be said to have been enshrined in this contribution.

This period of 5 years must have been almost the busiest of his life. During the later part of it I came for the first time into touch with him, and I was able to see for myself how little rest he took. His days were prolonged far into the night. He sought little relaxation, except in a change from one direction of work to another. His week-days encroached upon his Sundays; indeed, Sunday was usually a "Field Day," not only for himself but for all who were associated with him.

Attempting to analyze the character of Macewen, as I saw him, certain special *traits* seem to me to stand out very clearly. There was, first of all, *his infinite capacity for taking pains.* No amount of trouble was too great, if it meant the accomplishment of any good purpose, the clearing up of a difficulty, or the confirming of an observation.

Macewen was meticulous in testing his tools, as in verifying his facts. In his monograph on *Osteotomy* (20), considerable space is devoted to a careful description of the tools which he used, and one realizes, as one reads, what endless pains he

The old Royal Infirmary, Glasgow; Surgical Block. Lister's Wards, ground floor on left, marked by cross.

took, in order to secure just the right degree of temper of his osteotome, consistent with the striking of a happy mean between too great brittleness and too great softness.

There is the same indication in the story of his investigations into the problem of obtaining a method of preparation of catgut, so as to insure coincident tensile strength, sterility, and the necessary degree of resistance to the absorbent action of the tissues. He devoted much time and energy to the research; but neither time nor energy were grudged, for in the end he was able to elaborate a method which approved itself to him, and which he employed until the last.

His paper on "Chromic Gut: its Method of Preparation, and Behavior in Living Tissues" (21) represents what was to him a final and completed proof of the efficiency of the method, and he used catgut so prepared, for the rest of his life, i.e., for a period of over forty years. He was as confident, at the end, of the efficiency of his method, as he had been in the earlier years. It may be not without interest to my hearers if I say that his successor in office has, today, the same confidence in the method of Macewen as its author had. In the course of my hospital work for the past 25 years, I have used, continuously, catgut prepared according to the method of Macewen; and I continue to use it, with confidence and satisfaction.

Think, too, of the great numbers of ox-bones upon which Macewen tried out his operation of osteotomy before he finally assessed its applicability to the human subject. Again, the *infinite pains.*

Sir Charles Ballance, in a recent letter to me, made the following comment on Macewen's life and work:

" 'Genius,' says Carlyle, 'means transcendent capacity for taking trouble first of all,' and Macewen's genius seems to me to have been founded on a cultivated ability and determination to carry on everlastingly in his labor for surgery and for surgical pathology."

"In Ruskin's *Crown of Wild Olive* (42), there is a sentence which seems to fit Macewen's habit of life and manhood. Ruskin writes (he is speaking to young cadets on the subject of War): 'Remember that all the duties of her children to England may be summed up in two words—industry and honor. I say first *industry*, for it is in *that* soldier youth are specially tempted to fail.' "

"To Ruskin, Macewen as a *Surgeon Soldier* would have been a Hero." This appreciation of Macewen I think a particularly apt and true one.

A further trait of Macewen's character seems to me specially worthy of remark, namely, his *faculty for taking full value out of every part of his work*, no matter in what line his energies were employed for the time. There always seemed to present itself some problem on which he could exercise his active brain.

Thus, during the earlier part of his career, he was, for some years, Police Casualty Surgeon in the Central Division of Glasgow, and he made observations there on such minor problems as presented themselves. The drunk man or woman offered an opportunity to study the behavior of the pupil of the eye, in relation to the recognition of the effect upon it of alcohol. The result of such study is seen in a paper which Macewen published in 1879 upon "The Diagnosis of Alcoholic Coma" (18). In this paper he discussed the differential diagnosis of states of coma arising

The Western Infirmary, Glasgow.

from various injuries to the skull and brain, and their diagnosis from conditions due to alcohol. The "Macewen Pupil" has been recognized since then as a definite sign of alcoholic coma, and the value of the paper in differentiating this from coma due to injury, direct or indirect, to the brain or its membranes, has long been established.

Again, the many cases of wounding which were brought to the Police Station, particularly on a Saturday night, afforded an opportunity to study and classify wounds, according to the type of instrument causing them; and the results of Macewen's study were embodied in a paper entitled "Wounds, in relation to the Instruments which produce them," which appeared in 1876(17).

About the same time, a further paper appeared, entitled "Penetrating Wounds of Thorax and Abdomen" (16). The observations on which it was founded, though made in the routine work of a Police Casualty Surgeon, probably had something to do with the direction of his thoughts toward certain problems of thoracic surgery, that were to take more definite shape in the later years. This paper, one of his earliest efforts, was read before the Medico-Chirurgical Society of Glasgow in 1874, 5 years after he graduated, and when he was only 26 years of age. Mr. J. H. Pringle, one of Macewen's earliest assistants, pointed out, in the course of his memorial tribute to Macewen (41), that "the experience gained in connection with wounds of the thoracic wall would seem to have given him the first hint regarding his molecular cohesion theory, especially in connection with the pleural surfaces"—a theory that he was to develop at length over thirty years later.

In 1902, he read a paper before the Nottingham Medico-Chirurgical Society on the "Surgery of the Lungs" (29). His Cavendish Lecture in 1906 was entitled "Some Points on the Surgery of the Lung" (30). In it he expounded, at considerable length, his views upon the cohesion of the pleural surfaces. He had satisfied himself—it is doubtful if he ever fully convinced others—of the truth of these views. Much controversy was aroused on the subject. He returned to the fray on the same subject in 1913, when he contributed to the Seventeenth International Congress of Medicine, in London, a communication on "Intrathoracic Surgery" (32).

A somewhat melancholy interest is attached to the fact that what was, so far as I have been able to ascertain, his last published communication, dealt with much the same theme. It was given in 1923, before the Australasian Medical Congress, during the world tour which he made on behalf of the British Medical Association. Its title was "The Physics of the Lungs and Pleuræ" (34). Is it not a somewhat remarkable thing that this, Macewen's last paper, appeared almost exactly 50 years after his paper on "Wounds of the Thorax," which was one of his earliest? And the subject so nearly akin in each! What a gap in time, and "the wheel coming round full circle"!

A third trait must be referred to. It is what I would call, without offence, *his self-sufficiency*. Sir Donald MacAlister, in an address which he delivered, on the occasion of the Unveiling of a Mural Wreath and Tablet at Erskine, in memory of Macewen, on June 20, 1925, stressed the fact that Macewen was not a "co-operator" (15). It is true. Macewen had confidence in his own powers, his own resources, his own judgment. He did not readily accept the judgment of others.

He seemed almost to cultivate a spirit of distrust of anything that he had not himself put to the proof. Tradition meant little to him. Surgical dogma he accepted only where and when his own judgment was convinced, by his own observation and his own deduction. He exhibited the same habit of mind in his teaching of his students. He ever advised the student to ask himself, with each fresh page he turned, the question "Why?" He had much sympathy with the attitude of "philosophic doubt."

Most teachers are familiar with the type of student who is ever making supplementary, often awkward, inquiries. He has been dubbed "the anxious inquirer," but he is often a most useful fellow. He stimulates the teacher, and his fellow students, to further thought, to greater care in presentation of a clinical picture, to the avoidance of loose statement. Macewen, in my judgment, was the "anxious inquirer," *par excellence*.

I believe that, in his student days, Macewen was indeed such an "anxious inquirer," frequently waiting after a lecture to question his teacher, or to argue with him on some part of the teaching which was not clear to his mind. This attitude remained with him throughout his life.

But this habit of trusting, as he did, in his own powers, and doubting others, had the effect of making him incapable of co-operation with others in scientific work. "Team Work," the team spirit were not attractive to him, nor could he have remained for long as a mere member of any team. He would have "kicked over the traces" very soon. He believed in doing things for himself, and in having things done for him by others only where such others acted along the lines he, the Master, laid down. He was all right as the center of a little group, of which he was the controlling influence. But the work of the group must be his; its line of action his; its responsibility and its conduct his. He was, indeed, the typical individualist. In his little group he was supreme. He directed operations with skill. He had the faculty of getting the last ounce of work out of those who assisted him, because he gave the last ounce himself. And yet, one could have wished that he had been less of the individualist, more sympathetic to others engaged in scientific investigation, a little more complacent, a little more yielding. Even in respect of his attitude to his assistants, something of the spirit of co-operation would have been productive, I believe, of more good than harm.

How different was the attitude of Mikulicz, at the great Surgical School at Breslau! Twenty-six years ago, I spent some time there. Von Mikulicz, another great man, was then at the height of his activity and fame, and he had around him a remarkable group of energetic and able younger men. Von Mikulicz was the head of the School, and his spirit inspired the School to such effect that there issued from it, during these years, such a mass of important records, papers, and varied publications, dealing with subjects of great surgical interest, as has hardly been equaled—probably never anywhere surpassed—in the same period of time. This great output of work was the result of the highly developed "team spirit" that marked the whole working of the School. Nearly all the papers that issued from the Breslau School in that period appeared under the joint names of Mikulicz and one or other of his assistants. Mikulicz lost nothing by having the name of an assistant associated with his own. Each of his junior collaborators gained enormously by having associated with his name that of his great Master. And the Breslau School of Surgery gained in prestige all the time.

It is pleasing to be able to say that we have seen something of this collaboration, in recent times, in Glasgow, most notably, perhaps, in the departments of pathology and of physiology. And the result is there for all to see. I do not require to tell you of the success of the Glasgow School of Pathology. The Glasgow School—the Muir School—is well known, and deservedly famous. The work of the Glasgow School of Physiology is also well known. It may be said that so also is the Glasgow School of Surgery, and it is, of course, true. It could hardly be otherwise with a School that can show, on its roll of teachers, two such names as those of Lister and Macewen. I have often wondered, however, if it might not have been more famous still had Macewen been less of an individualist—more of the team worker.

Be that as it may, the fact remains that Macewen had the habit of working alone. He began his life work when knowledge of the bacterial agents of disease was meager and unreliable, when it was necessary to break down much erroneous tradition, and when the older beliefs of the pre-Listerian days had not yet been set aside; and these beliefs died hard. In the beginning, he worked alone, largely because he was one of the few who, from the first, accepted whole-heartedly the teaching of Lister; and the opposition, which those who believed in the Master's teaching had to encounter, was stiff and fierce. He acquired then, probably, a habit of mind and of work that became a part of his very nature.

The late Dr. McGregor-Robertson said of him, in the obituary notice which he contributed to the

Lancet (36): "Macewen had no charts of the region he set out to explore . . . no guide in the darkness he set out to illuminate. He had to devise his own methods; to forge his own instruments. He worked alone."

And even as he lived alone and worked alone, although surrounded by an always enthusiastic group of assistants, so also he lived alone in so far as his professional relationship with his fellows was concerned. I have said elsewhere (48) that Macewen "lived apart from the fraternity of his profession, and was always somewhat of a lone figure." The wonder of it all is that, in spite of all, he made so deep a mark on the whole trend of surgery in Glasgow.

There is one characteristic of Macewen's work which calls for special reference, namely, its *quality of thoroughness and completeness*. His research was thorough, and his deductions were not hurriedly made. He was careful that no misinterpretation of facts should lead him astray, and so, as has been remarked by Mr. J. H. Pringle (41), "He was never in a hurry to publish. When he made his statement, it was final; he had the proof of its correctness."

This note of *finality* is peculiar to much of Macewen's work, and much of his writing. One would not suggest that it is possible ever to reach finality in research, and Macewen would have been the last man to make such a claim; but one may say that Macewen explored every obvious avenue of approach, considered every possible source of error, made the most painstaking study of literature having any bearing on the subject, and having applied all possible tests, he was able to come to a conclusion which was to him final.

This does not mean that further research, even on the same line, was unnecessary. It might indeed mean, rather, that by the very establishment of this final position was rendered possible the making of a further step forward. It represented merely one more well-set rung in the ladder of advancing knowledge.

See how this may be illustrated from his own development. I have referred already to his early observations regarding wounds of the thoracic wall, and to his later work on the surgery of the lung, the second a natural development of the first. His classical work on the regeneration of bone, work involving enormous observation and much experimental research, was begun in or about 1878, and was continued during the rest of his life; but it is probably true that the paper which he published in the *Annals of Surgery* in 1887 (23) contains what one may regard as his final conclusions on the rôle of the osteoblast, and of the periosteum, respectively, in the growth of bone. He had proved conclusively, by the case which has become historic, in which he built up a new humerus by successive grafts of bone taken from six tibiæ, that bone could, in fact, be transplanted, and live in its new site. We have here, beyond doubt, the initial step which led to the more recent advance in the direction of bone-grafting. Macewen led the way, surely and firmly setting the step, over 47 years ago. His initial work, too, on the "Surgery of the Brain and Spinal Cord"—a finished piece of work, if ever there was one—formed the starting or leaping-off point for the great advances of more recent years. Surely, looking back upon his life's work, he must have had much satisfaction in what he was able to accomplish, once for all.

No sketch of the life and work of Macewen would be in any sense complete did it not include some more particular reference to three special aspects of his work. These are: First, Macewen's share in the development of modern aseptic surgery; second, his work upon bone; and third, his pioneer work upon the surgery of the brain and spinal cord. I propose to say a little on each of these themes.

Aseptic Surgery

It has been said that Macewen was fortunate in having begun his work exactly at the right time. Ballance has expressed something of the same idea, in his obituary tribute to Macewen (3), when he says: "Macewen lived through the most glorious period of British Surgery." And, indeed, that is true enough. Lister's great discovery had just made possible the great expansion that the world was to see in the succeeding years, and the discoveries of Humphry Davy, Horace Wells, Morton, and Simpson, with regard to the practicability, as general anæsthetics, of nitrous oxide gas, ether, and chloroform had but recently added further to the possibilities of surgical advance.

Without Lister's discovery, and the great boon of general anæsthesia, much of Macewen's work would have been impossible. To that extent, therefore, it may be admitted that Macewen was born at just the right time, when, as has been remarked by Patrick, in his memorial tribute to Macewen (40), the possibilities of surgery "were opening up like great tracts of undiscovered country." But one must admit that Patrick is right in adding, "a genius such as his would have found undiscovered country to explore in any period."

Macewen played a great part in commending to his fellows the Listerian doctrine of wound infection and its prevention. He was, from the first, an ardent disciple of Lister, and he endeavored to apply the Listerian doctrine in his work, from the earliest period of his career. His earliest papers show this.

In Glasgow, as elsewhere, there was much opposition, and an exponent of the Listerian principles, fearless and persistent as was Macewen, was a tower of strength to the cause. He gave a large place to the Listerian discoveries in the instruction he imparted to his students. In his systematic class at the University, he devoted a considerable time, each year, to the bearing of Lister's work on the prevention of wound infection. But he was not for long satisfied with the simple doctrine of antisepsis and of antiseptic surgery. He traveled farther than the Master.

At an earlier period, probably, than any other surgeon in Britain, perhaps even in any country, save possibly Germany, he had passed on to the development of what seemed to him the natural outcome of Lister's doctrines, namely, the ideal of asepsis and of aseptic surgery. Long before any of his fellows in Britain, he had developed in his clinic, and was teaching boldly to his students, what Sir Berkeley Moynihan has termed "The Ritual of a Surgical Operation," and his Ritual soon became strictly an aseptic one. During the last 25 years of his life, asepsis and aseptic surgery constituted the ideal in his practice and teaching.

Certainly, in one sense, Macewen was fortunate beyond many of his fellows, and more fortunate than most of the younger surgeons of later times. He was appointed to the responsible charge of wards in the Royal Infirmary, Glasgow, at the early age of 29; an age when, in the beginning of his manhood, he was full of vigor, and moved by great enthusiasm; when he had, still, the freshness of youth, and something of its boldness, even of its daring. To this extent he was, indeed, smiled upon by fortune. But, even before he became a visiting surgeon, he had begun to make his mark, and,—with particular reference to what I have said regarding his attitude to the problem of wound infection, and its prevention,—he had already published several papers, which proved how fully convinced he was of the surpassing importance of Lister's contribution to the science and art of surgery.

I have referred already to the tribute to his memory paid by McGregor-Robertson, and I venture to quote here, at some length, from the same article (36), an account of a pathetic little monologue of Macewen, recalled from memory by McGregor-Robertson, who was his medical attendant in his last illness. I quote it with all reverence—it shows how near to Macewen's heart the subject was:

> On one of these recent days, the writer stood, alone in the room, by the bedside of Sir William, when he lay, high on his pillows, enjoying a brief respite of peace and comfort from suffering. Quite suddenly and spontaneously, in his ordinary quiet and deliberate voice, he began to speak of Lister. Lister had brought into his class one day a book, from which he read to his students extracts from a paper by Pasteur, in which the French chemist explained his view that putrefaction was due to the operation of living organisms. Lister had consulted an eminent chemist of the day as to the chemical means by which such organisms might be destroyed in living tissues, and the answer he had received was that he could be supplied with a long list of such substances, but what their effect might be on the tissues it was for the surgeon to determine; but the chemist had added: "Try carbolic acid."
>
> These were days scarcely to be imagined or conceived by the surgical student of the present day, and death following amputation after amputation, in melancholy succession, was disheartening in the last degree.
>
> William Macewen, a junior student of surgery in the Royal Infirmary at that time, was a witness to these events, and, one morning, more than usually depressed by them, he came out of the Infirmary, and sat down on a bench to consider whether he could continue to pursue a study which could show only such results. An elderly woman of the domestic staff passed him, as he sat in gloomy contemplation, and, struck by his aspect, stopped and said: "What's makin' ye sae sad the day, laddie?" To which he answered, with a wave of the hand towards the hospital: "Who could help being sad at these things?" The woman replied that it would be to more purpose to go back and try to mend them. The student went back, back to a recent amputation, looked at the ligatures which projected in long ends from the wound. They looked dirty. He then had a look at the unused ligatures, which were made of hemp, and were kept in a jar. They did not seem clean. He then asked, and obtained, permission to try if boiling would improve them. From the ligatures he passed to the needles, and, without further request, passed to the instruments, with increasingly appreciable results. But he could not so secure the cleanness of the hands of the attendants who handled them all.

McGregor-Robertson makes the following further comment, which seems of interest, as representing the impression made on his mind at the time:

> The little monologue, of which the foregoing is but the substance, was spoken in a clear, quiet voice, without halt for fitting words, without delay of memory; as if the times, the occasions, the incidents stood out clearly in the speaker's mind, as but things of yesterday. But the tale was unfolded with, for that speaker, a most unusual quiver of the mouth, and moisture of the eyes. It was as if the speaker's mind traveled back down the long trail which he had followed, and saw, far down amid the darkness and cloud of ignorance and noisome pestilence, the very spot and moment from which he had consciously and deliberately set forth on a determined road—the bitter, narrow path of commencement, full of hindrance and obstacles, the toilsome, slow ascent—until, at last, he lay at rest upon the

shining peak—content. There was, in the quiet voice, no note of exultation; no self-glorification in the calm narration; only a fullness of content at the assurance that the task he had set himself to do, more than half a century before, had been accomplished.

It is certainly true to say that Macewen played a large part in developing the practical application of the Listerian doctrine. He was probably the first to use moist heat as a routine method in the sterilization of operation materials and dressings. He experimented extensively, in the effort to obtain a reliable way of preparing and disinfecting absorbable ligatures, sutures, and drainage tubes.

I remember how Macewen and his staff were, for some time, the only ones in Glasgow to clothe themselves in sterilizable white garments before entering the operating theater; and how they were held up to a good deal of ridicule for so doing. In time, the prejudice was broken down, and everyone followed his example, but he was undoubtedly the pioneer, though he did not always get the credit he deserved. The younger surgeons of today can hardly realize, as they carry out, unthinkingly, the routine of their aseptic ritual, how different were the conditions of barely 30 or 40 years ago.

I have alluded, earlier, to the close personal relationship which I was privileged to have, at one time, with Macewen, and I can testify, from the recollection of many conversations, to the admiration and reverence in which Macewen held Lister. I cannot refrain, however, from mentioning a memorable incident, which dates back now 32 years. It has reference to the one occasion, spoken of in an earlier part of this address, upon which I saw Lister. It is the more worthy of mention, in virtue of the glimpse it afforded of Macewen's attitude to the Master.

Lister visited Glasgow in the month of May, 1894, for the purpose of delivering an address to the University Medico-Chirurgical Society,—a Society of some antiquity, by the way, which originated about 120 years ago,—a student Society. It was a long promised engagement. His subject was "The Simplification of Antiseptic Treatment." The Hall of the Students' Union was crowded, as well it might be on such an occasion. In addition to students, there were present many members of the Senate, including Gairdner, Samson Gemmell, Buchanan, Hector Cameron, Joseph Coats, and Macewen.

When Lister had finished speaking, Macewen, as well as others, was called upon to speak. For a time he resisted the call. At last he rose, said a single sentence, and resumed his seat. It was this single sentence that expressed so clearly his attitude to the Master, and the effect it had upon the company was, I know, remarkable. It impressed us, in a way that hardly anything else could have done, as implying the deep reverence of one great man for an even greater. I should have liked to be able to quote that sentence with some degree of certainty, but, unfortunately, there exists some doubt as to what exactly Macewen did say. My own memory sometimes plays me strange tricks, and I am not sure that here it can be implicitly relied on.

My impression still is that Macewen said something like this: "When the nightingale sings, all the other birds are silent, lest their feeble notes disturb its song."

A colleague of mine on the Senate, however, who referred to the incident in my hearing last winter, and who was present on the historic occasion, as a very junior student, is of opinion that Macewen used the simile of the Contest of Song, where, "after the great singer had sung, no one dared to follow on, lest he disturb the echoes of his song."

A few weeks ago I put the question to another professional colleague, who had also been present on the occasion, as to whether he could recollect what Macewen said. Without hesitation he replied—"Oh, yes. Macewen used that quotation from *Richard II* (Act V, Sc. 3), 'As in a theatre, the eyes of men, after a well-graced actor leaves the stage, are idly bent on him that enters next, thinking his prattle to be tedious.' "

This conflict of evidence rather disconcerted me, so I wrote to another friend who, I knew, had also been present—he had, indeed, been the proposer of the vote of thanks to Lister—asking him if he could possibly recollect the correct version of Macewen's sentence. I told him of the three versions I already had, and I said in my letter: "For Heaven's sake don't send me a fourth version." His reply was, "I am sorry to say that I am no use to you at all. As to what Macewen actually said, I can believe any one of the versions you give me. It is a striking illustration of the vagaries of memory, as commonly met with in the analysis of evidence, that there are three similes in the field: nightingale for you, Meister-singer for C—, and actor for X—. As two plump for song, I'd rule out X—. As between the two songsters, I am inclined to back your nightingale, for Mac was a great lover of nature, though a staunch Wagnerian as well."

In any case, Macewen's reverence for the Master was such that, though Lister had said much in his address with which Macewen was not in agreement—indeed a good deal which Macewen thought unfortunate, especially as it was being put before

students, by such an authority—he was yet able to conceal his chagrin, and to say nothing that might imply the slightest criticism or disparagement of the Master. Lister had been pleading for simplicity in the application of his principles, and, perhaps unwittingly, had seemed to reflect on many who, like Macewen, had advanced farther even than himself along the road of natural development. No doubt Macewen felt this; and I know that he felt also that Lister's address contained a good deal that might be misinterpreted, and that might appear to afford some superficial justification for relaxation in the scrupulous care which he was accustomed to urge on his students as essential in the preparation for, and in the conduct of, any aseptic operative procedure.

Sir William Gairdner on one occasion—I am uncertain whether or not it was at the Lister meeting—characterized the position of Macewen and those who followed him by using a parody of the well-known phrase, *Ipsis Hibernis Hiberniores*. He altered it thus, *Ipso Listero Listeriores*. The application of the phrase to Macewen was undoubtedly an apt one, for Macewen, in his teaching and in his practice, did out-Lister Lister; in other words, he adopted the teaching of Lister regarding the causes of wound infection, and the general principles underlying antiseptic surgery, but he went further, and strove toward the ideal of microbic exclusion, and the attainment of healing of wounds free from infection. It is certain that, in his own practice, he very largely succeeded in the attempt, but not without many struggles against prejudice, and against the inertia of the self-satisfied and of the ignorant. Aseptic healing of wounds became the rule in his wards, instead of a fortuitous happening, and in time the influence of established fact began to assert itself far beyond the more immediate ambit of his practice.

The Surgery of Bone

I have thought, sometimes, that Macewen's work on bone must have been nearer his heart than any other of his scientific interests, for he seems to have had his mind directed upon some aspect of it at nearly every stage of his career.

The historic case, to which I have referred already, in which a new humeral diaphysis was built up, step by step, by a series of heteroplastic transplants, was first operated on by him as far back as 1878 (*22*), and he was able to follow out the after history of the case for over 30 years, so that, in his final conclusions on "The Growth of Bone," which he published in book form in 1912, he was enabled to give a comprehensive description of the process over that extended period of time, along with photographs showing the end-result of this great physiological experiment.

It can hardly be disputed that to Macewen, more than to any other, we owe the development of the more recent advance in the practice of bone grafting. Transplantation of bone can hardly be discussed in any scientific assemblage without reference being made to Macewen and his work.

It is difficult to escape the feeling that, in his researches on bone, Macewen's keenness was constantly being whetted by the recurring controversy upon the rôle of the periosteum in the regeneration of bone. He was the great protagonist for the view that regeneration of bone was the property of the essential bone cell, especially the active or embryonal form of this, the osteoblast. The volume referred to above, *The Growth of Bone* (*31*), embodied the results of an inquiry which was admittedly "undertaken to test by direct experiment problems connected with the growth of bone." In the preface, he indicates that this inquiry seemed to him to be necessary "as a firm belief exists that all periosteum produces bone,—such is the physiological teaching,—many believing that diaphyseal bone could not be produced without periosteum, and, once produced, would die were the periosteum removed."

To many thoughtful observers, the problem that Macewen set out to solve, the controversy that so intrigued him, and indeed his whole argument, were largely unreal, being based on the assumption of a much too literal and restricted interpretation of the anatomical and physiological teaching of the day, regarding the function and constitution of the periosteum.

"The periosteum," said Macewen, "is a limiting and protecting membrane, of great use in physiological and pathological conditions. There are no data to indicate that it can of itself secrete or reproduce bone. It has no osteogenic function." He held strenuously that in the activity of the osteoblast, and in it alone, resided the osteogenic property. He would not admit that the periosteum should be regarded as consisting of two layers: an outer largely fibrous and vascular, and an inner, containing, in the meshes of an areolar tissue, bone cells having osteogenic properties.

"That deeper layer," he would say, "is not periosteum. It is part of the bone." Or,

"These osteoblasts which you say may be found in the deeper layer of the periosteum should not be found there normally. If you are able to find them there, they are out of their normal habitat, as the result of some abnormal process."

In any case, the great periosteum controversy occupied Macewen much, both in argument and

in experiment, through the greater part of his active life, and anyone who might be anxious for an argument could always be sure of a ready lure to draw him forth to battle.

Macewen's work on bone, however, found a more useful field of application than that with which I have just dealt. The surgical treatment of bony deformities early attracted his attention.

Almost from the beginning of his career, he turned his mind to the deformities associated with rickets, a disease then particularly prevalent in Glasgow. These deformities could hardly escape the notice of anyone moving about the city. Up to the time when Macewen began his work, no satisfactory method had been devised to deal with them. Macewen took up the work, directing his attention not merely to the surgical correction of the deformities, but to an inquiry into the cause of the disease. His first article on the subject, which appeared in 1878, that is, one year after his appointment to wards in the Royal Infirmary, was entitled "Antiseptic Osteotomy for Genu Valgum"(19). Other papers quickly followed, and Macewen pursued his observations and practice on a large scale, so that he was able, in 1880, to publish, in book form, his monograph on *Osteotomy* (20). At the time of its appearance, he had operated on 557 limbs, in 330 patients. Of the 330 patients, 220 had genu valgum—367 limbs; 110 patients had bow-legs, anterior tibial curves, and other tibial curves, and ankylosis of the hip and knee—190 limbs. These numbers did not completely represent the total number of osteotomies performed, for in many cases multiple operations were required. The total number of osteotomies actually carried out was, in fact, 835. It is not possible here to detail the important data presented by a consideration of this large series of cases, though these are given at length, and with detail, in the book; but it is worthy of note that, out of the whole list, only three patients died: one from pneumonia, contracted prior to operation, one from tuberculous meningitis, and one from diphtheria. Considering the fact that the great majority were dealt with in the earliest days of the Listerian régime, such a result is remarkable, as is also the further fact recorded in the book, that, in the whole series, all the wounds healed without pus production, with the exception of eight cases. In only one of the eight did wound infection lead to serious trouble—surely a wonderful record for that time.

The publication of this monograph at once attracted widespread attention, and Macewen's operation of supracondyloid osteotomy soon came to be accepted as the operation of choice for the correction of genu valgum. Various other operative procedures had been devised, notably by Ogston of Aberdeen (38), and by Chiene of Edinburgh (4). But these operations were not long to stand comparison with the operation devised by Macewen, whose book speedily took rank as a standard work, and was translated into every European language.

I have told elsewhere (48) how remarkable a personal triumph Macewen achieved in connection with his work on osteotomy, but the story will bear repetition, not only in respect of the remarkable ascendancy achieved by Macewen, but also by reason of the graceful way in which other surgeons accorded, to him and to his operation, the credit which meant for themselves the abandonment of their own special operative methods. The reference is to the Meeting of the Section of Surgery at the Congrès International des Sciences Médicales, held in Copenhagen in 1884, when there was a great discussion on the operative treatment of genu valgum. In this discussion, full and exhaustive consideration was given to the comparative results, and the respective merits, of the operations of Macewen, Ogston, and Chiene. The discussion took place 4 years after Macewen's book was published, so that Macewen was able to deal with larger figures than those in his book. He had prepared an elaborate statement, giving comparative statistics, on his own and other methods of operation. This he submitted with convincing force. The following is a short summary of the discussion which took place thereafter: It may be found in the *Transactions of the Congress* (35).

Ogston said that the time had now come for formulating the conclusions which experience justified, concerning the merits of the various operative procedures. The statistics submitted by Macewen, though he, Ogston, had not yet digested them, spoke powerfully in favor of Macewen's operation. Ogston confessed, without hesitation, that they corresponded with the conviction at which he, personally, had arrived. Ogston went on to say: "Since Macewen's operation was made public, I have given it a fair trial, generally performing it alternately with my own; often, in the same patient, treating one limb by Macewen's method, and the other by oblique section of the condyle. I must say that I have never seen other than perfect result, in my own hand, from my own operation, but I know that this has not been the case with others, and I have therefore become satisfied that Macewen's operation is the one best suited for the operating surgeon in general. It has the advantage of being applicable in young children, whose ossification has not been completed, that is to say, where oblique section by my method would be unwise. Mikulicz has shown also that Macewen's osteotomy is the proceeding that best corrects the deformity, in accordance with the views regarding the situation of the disease that his investigations have established. I have, therefore, for some time, taught that Macewen's is the best operation

for genu valgum, and here, in this great Congress, before so many and eminent authorities, I give in my adhesion to it." Surely a strikingly graceful admission, which must have required, for its making, a man of big and generous nature.

Chiene, who followed, said that it was evident, from the clearly given statistics of Macewen, that the profession had given, by a large majority, the preference to Macewen's operation. In these circumstances, he, Mr. Chiene, felt it to be his duty to state that he would try Macewen's operation on his return to Edinburgh. He congratulated Macewen on his great success.

Bryant, of London, said that he thought the Section, after hearing what had been said, would scarcely find it necessary to discuss further the relative value of the operations. They would all agree that Macewen's operation had been approved by statistics, and also by the fact that the authors of the other methods had now practically given them up. He must say, for himself, that he had used Macewen's operation many times, with very great success, and it was gaining ground where, previously, Ogston's operation had been practised. He was sure the Section would endorse what had been said about Macewen's operation being the best one; but he could not sit down without expressing the very great pleasure he felt at the manner in which the other gentlemen had given up what he might call their pet operations. Professor Ogston had done this with the greatest possible grace; and he, Mr. Bryant, was sure the Section would award him, and the others, a vote of thanks for the manner in which they had acted.

It is surely given to few men to achieve such a complete international triumph.

I have mentioned that Macewen's monograph dealt also with the causation of the malady which led to the deformities, and it may be said that though his views on the etiology of rickets necessarily did not deal with, or even foreshadow, the more modern views on the biochemical and other agencies to which many now ascribe the production of rickets, yet his conclusions as to the influence of bad hygiene, the want of pure air, the absence of sunshine, the effects of chronic ailments, and perhaps of epidemic diseases acting during the growth period, are still worthy of consideration, even in the light of modern knowledge.

The Surgery of the Brain and Spinal Cord

Macewen undoubtedly achieved his greatest fame as the pioneer of brain surgery.

At the meeting of the British Medical Association in Glasgow in 1888, he gave, by request, an address which has become historic. It was so remarkable a contribution to surgical knowledge, and to the surgical literature of the period, that it overshadowed the address of the president of the Surgical Section. Comments in British and foreign medical journals of the period show what a sensation was produced throughout the world, and the references to it in the lay press were equally enthusiastic. I am just old enough to remember something of the sensation it caused, though my impressions were derived then solely from perusal of the daily papers.

The *British Medical Journal* referred to it as "in many respects the most remarkable contribution to surgical literature which the present day has produced." The journal went on to give extracts from the address, singling out some of the most striking details, and continuing thus:

"With these samples of Dr. Macewen's address, our readers will not think us extravagant in saying that it marks an epoch in surgery, the initial stage of a branch of our art obviously destined to a glorious and beneficent future. All honour to the surgeon who has so ably, so successfully, led the way in this grand undertaking."

"After his address, Dr. William Macewen gave a demonstration of cases so remarkable that it alone would suffice to render the Glasgow meeting memorable in the annals of surgery. Many of the patients whose cases had been described in the address were present."

No wonder that, at the close of the meeting, there was a scene of enthusiasm such as lived in the memory of all who were privileged to be present. The address was entitled "On the Surgery of the Brain and Spinal Cord" (24).

Thirty-four years later, when the British Medical Association again met in Glasgow, in 1922, Macewen, now its President, took as the subject of his presidential address practically the same theme as in the address of 1888. The title on this occasion was "Brain Surgery" (33). He was able to show how his observations and conclusions of so many years ago had stood the test of time, and he dealt at considerable length with some of the problems of further advance. He stressed the importance of careful observation, the paramount necessity of attention to detail, even the smallest detail, in the investigation of cerebral lesions. He had dealt with this subject in his original address; he returned to it again, and illustrated what he had to say in this connection by many striking examples. His presidential address was, in fact, a comprehensive survey of his own work during the 34 years that had elapsed; but it was more than that. It was a masterly survey also, not only of the more recent developments in the surgery of the brain, but of the great possibilities of the future.

It may be of some interest to consider briefly what were the steps by which Macewen's great work on brain surgery came to be suggested and rendered possible. He has himself supplied the clue. In his original address, he said:

"The full force and significance of the experiments of Fritsch and Hitzig in 1870 were not recognized until Ferrier's observations on the brains of animals (monkeys), undertaken to put to experimental proof the views entertained by Hughlings Jackson, were published in 1873. Another link in the unity of the plan of creation was

manifest, as, even in the higher and more complex brain of man, parts existed whose functions found homologous expression in that of the lower animals."

The sequence of events, looked at from the point of view of historical scientific development, may be summarized at slightly greater length, thus. I quote from my presidential address to the Royal Medico-Chirurgical Society of Glasgow in 1924 (49).

"The development of exact anatomy; the equally important development of the science of pathology; the progressive growth of physiology from Harvey (1578–1657) to Haller (1708–1777); the modern science of histology, which may be said to have been founded by Bichat, who died in 1802, at the early age of 31; the work of Schleiden and Schwann on cellular physiology (1837 and 1838); the correlation of all these, and of many other factors, led directly or indirectly to the epoch-making advance of the science of cranial surgery in the latter part of the nineteenth century.

The introduction of the ophthalmoscope, by von Helmholtz, in 1849; the first accurate proof of cerebral localisation by Broca, in 1861, when he demonstrated *postmortem* a lesion of the third left frontal convolution, in a man who had not been able to speak for 21 years; the pioneer lectures of Hughlings Jackson (1835–1911) on the *Diagnosis of Tumours of the Brain* (12); Jackson's classical papers on *Epilepsy* and on *Affections of Speech;* von Graefe's demonstration of the association of optic neuritis with cerebral tumour (46); the marking out, by Fritsch and Hitzig, in 1870, of certain centres in the brain by electrical stimulation (9); the classical experimental work of Ferrier on the brains of monkeys, by which he proved beyond question the localisation of function in the cerebral cortex; his demonstration at the International Medical Congress, in 1881, of two monkeys on whose cerebral cortex experimental injuries had been inflicted, one monkey having a characteristic cerebral hemiplegia, while the other had lost its hearing: these finally proved beyond all doubt, that cerebral function, and, indeed, the function of the whole cerebrospinal system, were localised and localisable. Further experimental research, and the microscopical investigations and staining methods of Clarke, Marchi, Golgi, and others, but completed and amplified the evidence."

I have outlined only a few of the most signal discoveries—many more might have been cited—which stand out as milestones in the path of the great advance in cranial surgery in the last century. One might change the metaphor, and say that they represent successive rungs in the ladder of growing knowledge which made possible the later triumphs. They led up to, and made possible, the famous work of Macewen, Horsley, Bergmann, Keen, Cushing, Ballance, and others.

Horsley, like Ferrier, did much experimental work himself. The results of some of his earliest experimental work he reported in a paper he read at Brighton in 1886 (10), in which he described a number of cerebral cases, and correlated the diagnosis in each case with his experimental work on the brain of the monkey. A year later, he described ten cases—examples of cerebral surgery—and elaborated the importance of experimental physiology (11).

Macewen, in his great address at Glasgow, in 1888, gave an account of twenty-one cases of cerebral lesion, operated on with only three deaths. While the success of the operative record was remarkable, perhaps the most outstanding feature of the address and demonstration was the account of the accurate correspondence of functional disturbance and clinical signs and symptoms with the operation findings.

It has been suggested, sometimes, that Horsley's work took precedence of Macewen's; that, in fact, Macewen was not the pioneer. But such a claim cannot be supported. Percy Sargent has pointed out (44):

"He (Macewen) has indeed been called the father of brain surgery, for his early work antedated by several years that of Victor Horsley. In an obscure corner of the *British Medical Journal* of December 27, 1879, it is recorded that Macewen showed, before the Glasgow Pathological and Clinical Society, two patients upon whom he had successfully operated: in the one case, for hemiplegia due to a subdural hæmorrhage, and in the other, for a tumour in the left frontal region. This second case is fully recorded in the *Glasgow Medical Journal* of September, 1879. It concerned a girl, fourteen years of age, from whom a supra-orbital periosteal tumour had been removed twelve months previously. The tumour recurred, and convulsions appeared, which involved the right face and limbs. Macewen trephined in the left frontal region and found the bone to be thick and soft, whilst beneath it lay a 'soft flattened gummatous tumour' of the dura mater, similar to the tumour lying on the outer surface of the bone. The tumour was removed. No bad symptoms followed the operation, and the paralysis disappeared. It is almost certain that this tumour would now be recognized as a meningeal endothelioma."

Horsley and Macewen were undoubtedly great co-workers in the early development of brain surgery. In a sense they might be regarded as rivals, but this rivalry, I am confident, was less in their own minds than in the minds of their respective supporters. I believe that each would have been concerned less in claiming for himself priority over the other, than in acknowledging the great debt that both owed to those who, like Hughlings Jackson, Fritsch, Hitzig, and Ferrier had made the way clear.

Great as was Macewen's work on the surgery of brain tumors, and their localization, he stands out even more clearly as the pioneer in the diagnosis and surgical treatment of intracranial suppurative conditions. He was fortunate, at a very early period in his career, in being brought into association with the work of the late Dr. Thomas Barr of Glasgow, particularly at the Ear Hospital, and, as always, he took full advantage of the opportunities presented there, through this association,

to study in all its bearings the manner of development of the different types of intracranial spread of infection from ear disease. This study became a matter of absorbing interest to him, all the more as fresh light began to be cast on the manner of infective spread, and on the possibilities of its prevention and its surgical treatment.

The association of Barr with Macewen—it is perhaps the only example in Macewen's career of something approaching the spirit of co-operation—was one of the most fortunate and most fruitful associations in the history of modern surgery, for it led to the laying of the groundwork of most of our present-day knowledge on the subject, and of present-day procedure in the operative treatment of intracranial abscess, meningitis, and sinus thrombosis.

Macewen's classic work on *Pyogenic Diseases of the Brain and Spinal Cord* was published in 1893 (28), and, as I have said, it remains a standard work today. In virtue of its style, the methodical recording of the cases described in its pages, the reliability of the observations detailed, and the comprehensive survey which it takes, it has few rivals in modern surgical literature. It suggests, better perhaps than any other of Macewen's writings, the scientific genius of its author. It is hardly too much to say that the surgical teaching and practice of today, in respect of pyogenic intracranial disease and its treatment, are mainly based upon, and, indeed, in great measure synonymous with, the doctrine first laid down in comprehensive form in this great work.

Well might Sir William Osler say (39)—*a great tribute*—: "A most important, one might almost say essential, factor in the successful treatment of intracranial suppuration, is an intelligent knowledge, on the part of the surgeon, of the work and works of William Macewen."

Macewen as an Operator

Very brief reference may be made to Macewen's powers as an operator. One would not claim that he was naturally dexterous, or that he was an operator heaven-born. He was, indeed, slower and more deliberate than many surgeons of his day. In his operative work, he seldom troubled himself about the matter of time; and there were occasions when those of us who worked with him were inclined to regret that he would not hurry just a little. As Patrick has said (40), he aimed "at thoroughness rather than speed and dexterity. It is not likely that he had any use for the American phrase, 'Get in quick, and get out quicker.' "

It is quite certain that, in certain branches of surgery, Macewen had perhaps less than the average facility, and less than the average success; but in those branches of the art which he had done so much to advance, and in which he was the unrivaled master, he was *facile princeps*.

To see Macewen do a mastoid operation; to watch him perform a radical cure of hernia, according to the method which he himself devised; to witness a supracondyloid osteotomy of the femur done by him for genu valgum, was to witness a finished work of art—a thing never to be forgotten.

Macewen as a Teacher

With his appointment to the Regius Chair of Surgery in the University of Glasgow, Macewen turned his mind seriously to the duties of teaching. By this time, what one may speak of as his creative period had been passed, though, in such a man, the spirit of inquiry and research inherent in his being could never be actually quenched. Nor was it. He continued, to the end, imbued with the spirit of inquiry, and did not cease his investigations. But he put his professorial duties always first, and did everything in his power to implement the new responsibilities that he had undertaken. He spent much time and labor in preparation for his class work, took great trouble, and expended much ingenuity, in the construction of diagrams and models for teaching purposes, and he succeeded in making a deep impression on the teaching of surgery in Glasgow, an impression whose influence was felt far beyond the University.

Macewen was not a great teacher of systematic surgery. His *métier* was as a teacher of clinical surgery. I have heard him say, long ago, that it had been his ambition to establish a great clinical school like the school of the great Kocher of Berne. And, indeed, there was a certain similarity of method in the clinical teaching of these two men. Each was accustomed to go very fully into the differential diagnosis of his cases, in the presence of large classes of students. As each successive case was dealt with, two or three students were selected, brought down to the floor of the class room, and taken very closely over the details of the case. They were quizzed often somewhat rigorously, but seldom unmercifully, by the chief. All the most likely possibilities were explored, and argued out, in the presence of the class—to the interest, and often to the amusement, of the latter, but certainly to their enlightenment—until, by a process of exclusion, the most likely diagnosis was arrived at.

It must be confessed that, at the end, it did not always happen that Macewen would declare his

own diagnosis in the case. One was often left in doubt as to what Macewen's diagnosis actually was. In this respect Kocher was different. He was accustomed to declare his opinion. Then followed, in the case of Kocher, the inevitable question: "*Was sollen Sie thun?*" Macewen often left this out. He was concerned more to show the student how to arrive at a diagnosis, than in forcing from him a declaration as to treatment. But, in any case, those mornings in the clinic were unforgettable, and Macewen's students had certainly little excuse for failure to become proficient in the art of diagnosis.

I have spoken already of the spirit of healthy doubt which he was accustomed to instill into the minds of his students, and of his constant injunction to them to put to themselves the perpetual interrogative. That may be said almost to symbolize his principle of instruction,—to make the student think for himself.

Reading Sir Berkeley Moynihan's description of Murphy as a teacher and lecturer, I cannot help feeling that there must have been a certain similarity between Murphy and Macewen in respect of their lack of many of the graces of speech, a lack that was wonderfully atoned for by this same faculty of making those who listened to their words think for themselves. It must very seldom have happened that a listener to either of these great men was sent away without some new thought, some new idea, perhaps some suggestion of a new line of investigation.

I am reminded of a remark of Matthew Arnold which seems apposite. You will find it in his volume on *Culture and Anarchy* (1). He is contrasting the oratory of Pericles with that of Socrates:

> "Pericles was perhaps the most perfect speaker who ever lived, for he was the man who most perfectly combined thought and wisdom with feeling and eloquence. Yet Plato brings in Alcibiades declaring, that men went away from the oratory of Pericles, saying it was very fine; it was very good; and afterwards thinking no more about it. But they went away from hearing Socrates talk, he says, with the point of what he had said sticking fast in their minds, and they could not get rid of it."

In this sense, it seems to me, the teaching of both of these great men, Murphy and Macewen, must have had something of the fruitfulness of the Socratic method of instruction to which Matthew Arnold refers.

Macewen was very jealous of the Scottish methods of teaching the student, and of training the young surgeon. He viewed with disfavor any attempt to graft the English tradition in teaching upon that in force in the Scottish schools. He was a strong protagonist for the teaching of operative surgery, as a part of general surgery, and he succeeded, not without encountering considerable opposition at first, in obtaining a well-equipped department for the prosecution of the practical part of his operative surgery course, as well as for the purposes of research.

His aspirations for the school of surgery of which he was the official head were ever of the highest. He would never have been content to see it assigned a place less than the highest. I remember hearing him, on one occasion, address the then inspector of anatomy—at a time when the supply of material for the use of teachers of anatomy and surgery had become much restricted and when it was being suggested that the claim of the operative surgery department should give place to that of the anatomy department—in these words: "But, Sir, surely you do not wish to reduce the Glasgow School of Surgery to the level of the X—Schools?" This question may be taken as typifying or epitomizing his aspiration for the Glasgow school:—"ἀιεν ἀριστευειν"—(*Ever to be the best*).

Macewen and His Assistants

Ruskin has said (43): "And the first duty of every man in the world is to find his true master, and, for his own good, submit to him; and to find his true inferior, and, for that inferior's good, conquer him. The punishment is sure, if we either refuse the reverence, or are too cowardly and indolent to enforce the compulsion." Macewen held in high reverence his great Master. Equally, he compelled the acquiescence and the service, of those who were his students, his nurses, his house-surgeons, and his assistants. He exacted obedience, and he showed little consideration for anyone associated with him whose service was not scrupulously loyal. But, with all the loyalty and respect of those who worked with him, there was something wanting. Macewen habitually seemed to move on a plane of his own. He seldom unbent. A few of us, who were specially privileged to see him in one of those rare moments when he did unbend, treasure the remembrance in our hearts. One of those rare occasions I cannot refrain from mentioning. The memory that lives with me still, after over 30 years, is of an occasion when I was invited, along with a number of senior students, to dinner at his house. After dinner, when we repaired to the drawing-room, Macewen entertained us, and his family, by reading,—for the special benefit, no doubt, of the youngest member of the family, who was perched on his knee during the reading,—a fairy tale, translated, I think, from the Norwegian. Those of us who had been accustomed to look up, almost with awe, to Macewen,

as we saw him in hospital, could not fail to be struck by the apparent incongruity of our conception of the great man, with the spectacle we had of him reading a fairy tale to a small child seated on his knee.

I have spoken of the "something wanting." Job has said (xxxii, 9) that "Great men are not always wise." Of no one, probably, is such a saying more true than it was of Macewen. Like many great men, he was not without the defects of his great qualities. He failed just where he ought to have succeeded. He earned respect, he excited admiration. He gave, by his energy, his industry, his originality of thought, his brilliant research, an example for all to strive after. It is extremely doubtful, however, if he ever could be said to have gained, or even if he ever desired to gain, the affection of those who were his most loyal helpers. Many of us, who were brought into close relationship with him and with his work, often felt this as a defect in his quality which was to be regretted, all the more that such affection could so easily have been his. Macewen would have been none the less great, but surely greater, had the general admiration and respect accorded to him been supplemented by a general feeling of affectionate regard.

I had occasion, some time ago, to speak to a friend whose opinion I value, regarding the place which Macewen might be held to occupy in respect of his personal qualities, in comparison with Lister and Paget. My friend, whose name, for obvious reasons, I withhold, said: "I had the privilege of knowing well both Lister and Paget. Macewen did not reach their level, I think, though he was a great man. When I met Lister or Paget in consultation, or when either of them was examining a microscopical specimen of mine, they always gave me the impression that they desired to learn from me! Now, this appears to me the ideal way of encouragement for a really great man to treat a very junior person belonging to the same profession. I may be wrong, but I cannot visualise Macewen acting in this way."

It must be admitted that there is much of truth in this criticism, but Macewen's defects, such as they were, only serve to bring into more marked relief the greater qualities of the man whose genius was dedicated for so long to the service of the University of Glasgow, and of the great surgical school of which he was the head.

Macewen and the University

On the Professorial Roll of the University of Glasgow are inscribed the names of many famous sons; of many who have done notable work for the advancement of knowledge, and for the benefit of the whole human race. The traditions of well-nigh four hundred years cluster around names, almost too numerous to mention, of men, who, in their day and generation, have done much to advance the efficiency and repute of their Alma Mater. In the long and distinguished Roll, few names can rival, probably none can outshine, those of the immortal Lister, or of his great disciple, Macewen.

A good many years ago, in a short memorial sketch of von Mikulicz, which I contributed to the *Glasgow Medical Journal* (47), I told the story, culled from the columns of the *Frankfurter Zeitung*, of June 17, 1905, of the great Billroth, who when overwhelmed by the great numbers of patients seeking his professional advice, some of whom came from Krakau (where Mikulicz, a pupil of Billroth, was then professor of surgery), turned on them, and cried: "Why do you come to me? Have you not Mikulicz in Krakau? He understands his business quite as well as I, and operates still better."

There, surely, was generous tribute from great master to great pupil.

I am reminded of this tale by the following story recently related by one who used to be well known in Glasgow:

"A good many years ago, I met five Englishmen on the steamer between Hamburg and Leith. They had graduated in medicine in London, and had been afterwards in Berlin with Professor Bergmann, for a session of post-graduate study. When they parted from Bergmann, he said to them,—'If you can spare the time, I would advise you to go to Glasgow, to Professor Macewen, for a session. Afterwards, no man can teach you more.'"

There, surely, was generous tribute from great surgeon to his great international rival.

It cannot be denied that, in the possession of Macewen, the University and City of Glasgow were richly dowered by Fortune. The name and reputation of Glasgow and of surgery in Glasgow were held in high honor by all who knew Macewen and his work. His clinic was visited by surgeons from all the world, who came to see his work, for themselves, and to listen to his words. At one time, indeed, he was almost better known abroad than at home—such is the proverbial fate of the prophet. It was certainly so in his case. It is of interest to recall that it was much the same in the case of Lister. Indeed, especially in the earlier years of his work at King's College, London, Lister had to contend with more than mere ignorance and apathy on the part of students and

professional colleagues in London; he had to encounter much opposition, even spiteful opposition. But at least such apathy and ignorance toward his revolutionary work did not extend to foreigners, who, almost from the first, used to crowd the benches day after day, in his lecture theater; so much so, indeed, that the few regular students were apt to be crowded out, and ultimately made complaint about it.

Abroad, the name of Macewen was well known. It was one to conjure with. I found it so, when, in my earlier years after graduation, I was able to visit a number of the most famous continental clinics. A card of introduction from Macewen did much to smooth my way. His name was a sort of "Open Sesame" everywhere. Then it was that I realized, if never adequately before, how big a man we were privileged to have at the head of the Glasgow School of Surgery.

I have wondered, sometimes, whether Glasgow has ever fully appreciated its great good fortune in the possession of Macewen, or how nearly, on more occasions than one, the school came to losing him.

It is no secret that Macewen was invited on more than one occasion, to accept appointment elsewhere—notably when he was urged, very strongly and persistently, to join the great School of the Johns Hopkins University at Baltimore. All kinds of lures were held out to him, to induce him to go there, but he declined, and persisted in his decision to remain in Glasgow.

In an initialed memorial contribution to the *British Medical Journal*, of date March 29, 1924 (13), the story of this attempt to lure Macewen to Baltimore is told. The account may be somewhat highly colored, but there is reason to believe that, in its main facts, it is substantially correct. The following is a brief outline of the story: "When the Johns Hopkins School was being established, those in control searched the world for men of outstanding ability, in research or in teaching capacity. Macewen was invited to join the staff, but declined appointment. It was made clear that salary was no object, and that a great practice awaited him. He declined. He was told that the surgical wards to be built would be erected to suit his wishes. He still declined. He was then invited to bring with him, up to any reasonable number, assistants and nurses. Still he declined. Finally, he was invited to take a long holiday, to come over to Baltimore, and, incidentally, to advise about the establishment of the new School, suitable remuneration being promised. Even this attractive offer failed to induce him to leave Glasgow, and that was the end of the project."

It would be idle to suppose that such an invitation was not a considerable temptation, even as it was a very high compliment, to Macewen. It came to him, however, just at the time when he was busy with his great work on *Pyogenic Diseases of the Brain and Spinal Cord* and with the preparation of his *Atlas of Head Sections*, to which reference was made in the earlier part of this address. It reached him, therefore, during the exceedingly busy 5 years following the delivery of his address on *The Surgery of the Brain and Spinal Cord*. No doubt he felt that it was impossible for him to interrupt his great work at such a time.

The circumstances of the situation, and the decision to which Macewen then came, remind one of the reply of Nehemiah, to those who urged him to go down to commune with them without the wall which he was engaged in building:—"And I sent messengers unto them, saying, I am doing a great work, so that I cannot come down; why should the work cease, whilst I leave it, and come down to you?" (Nehemiah vi, 3). Baltimore's loss was surely Glasgow's gain.

Shortly after the death of Macewen, steps were taken in Glasgow, by a committee of which I had the honor to be Hon. Secretary, to establish a fund, the purpose of which should be to initiate a memorial of his life and work. That fund has been obtained, and the conditions of its application are now finally determined. The first purpose of the fund was the obtaining of a memorial bust, in bronze. This bust, by Paulin, has been made, and has been formally handed over to the custody of the University; a replica being presented to Lady Macewen. The second purpose of the fund has been arranged for, in the provision of a medal, to be awarded to the most distinguished student in surgery of each year. The first award has still to be made. The third, and perhaps the most important purpose of the fund, it was decided, should be the establishment of a Macewen Memorial Lectureship. The appointment of Lecturer will fall to be made by the University Court, acting on the advice of a small committee of three. The Memorial Lecture, according to the terms of the foundation, may deal with any subject bearing on the advancement of surgical science. It may be of interest to state that the Inaugural Macewen Memorial Lecture is to be delivered next year, by your countryman, and former President, I think, Professor Harvey Cushing.

But, after all, we shall remember Macewen not so much in virtue of artificial aids of such a kind. In the words of the editor of *The Medical Journal of Australia* (6), speaking of Macewen:

"Great men are remembered more by the fruits of their work than by monuments erected by their contemporaries."

So we remember, with gratitude, the life and work of William Macewen. The fruits of his work are with us, and are known to us.

I, his humble successor, commend to you his great memory.

REFERENCES

1. Arnold, Matthew. Culture and Anarchy. Conclusion. 1869.
2. Ballance. The History of the Surgery of the Brain. 1922.
3. Idem. Obituary tribute to Macewen. Brit. M.J., 1924, March 29.
4. Chiene. Discussion on Chiene's operation for genu valgum. Edinburgh M. J., 1879, 651, May.
5. Duncan. Memorials of the Faculty of Physicians and Surgeons, Glasgow, 1896, p. 173.
6. Editorial. The Macewen memorial. M. J. Australia, 1925, May 23.
7. Ferrier. Experimental researches in cerebral physiology and pathology. West Riding Lunatic Asylum Rep., 1873, iii, 30.
8. Finlayson, James. Account of the Life and Works of Maister Peter Lowe. 1889.
9. Fritsch and Hitzig. Ueber die elektrische Erregbarkeit des Grosshirns. Du Bois Reymond's Archives, 1870, 300.
10. Horsley. Brain surgery. Brit. M. J., 1886, ii, 670.
11. Idem. Remarks on ten consecutive cases of operations upon the brain. Brit. M.J., 1887, i, 863.
12. Hughlings Jackson. Diagnosis of tumors of the brain. Med. Times & Gaz., 1873, ii, 139, 195, 541.
13. J. M. Obituary tribute to Macewen. Brit. M.J., 1924, March 29.
14. Lawrie and King. Statistics of injuries of the head. Lond. & Edinb. J. M. Sci., 1844, April.
15. MacAlister. Memorial address at Erskine Hospital. Glasgow M. J., 1925, July.
16. Macewen, Sir William. Penetrating wounds of thorax and abdomen. Glasgow M. J., 1875, n.s. vii, 1.
17. Idem. Wounds, in relation to the instruments which produce them. Glasgow M. J., 1876, n.s. viii, 28.
18. Idem. The diagnosis of alcoholic coma. Glasgow M. J., 1879, ii, 1.
19. Idem. Antiseptic osteotomy for genu valgum, genu varum, and other osseous deformities. Lancet, 1878, December, 911; 1879, April, 586.
20. Idem. Osteotomy; an inquiry into the Ætiology and Pathology of Knock Knee, Bow Leg, and Other Osseous Deformities of the Lower Limbs. 1880.
21. Idem. Chromic gut; its method of preparation and behavior in living tissues. Ann. Anat. & Surg., 1881, iv, 129.
22. Idem. Observations concerning transplantation of bone. Illustrated by a case of interhuman osseous transplantation, whereby over two-thirds of the shaft of a humerus was restored. Proc. Roy. Soc., Lond., 1881, xxxii, 232.
23. Idem. The osteogenic factors in the development and repair of bone. Ann. Surg., 1887, vi, 289, 389.
24. Idem. On the surgery of the brain and spinal cord. Brit. M. J., 1888, ii, 302.
25. Idem. Articles on various subjects. Dictionary of Practical Surgery by Christopher Heath. 3d ed., 1889.
26. Idem. On aneurism: its cure by inducing the formation of white thrombi within the sac. Brit. M. J., 1890, ii, 1107 and 1164.
27. Idem. Introduction to a discussion on anæsthetics. (Glasgow Med.-Chir. Soc., 1890) Glasgow M.J., 1890, xxxiv, 322; also concluding remarks on anæsthetics (same discussion). Glasgow M. J., 1891, xxxv, 32.
28. Idem. Pyogenic Diseases of the Brain and Spinal Cord. 1893.
29. Idem. The surgery of the lungs. Lancet, 1902, ii, 1329.
30. Idem. Some points on the surgery of the lung. (Cavendish lecture.) Brit. M. J., 1906, ii, 1.
31. Idem. The Growth of Bone; Observations on Osteogenesis; an Experimental Inquiry into the Development and Reproduction of Diaphyseal Bone. 1912.
32. Idem. Intrathoracic surgery. (17th Internat. Cong. Med., London, 1913.) Lancet, 1913, ii, 551.
33. Idem. Brain surgery. Presidential address, British Medical Association, Glasgow, 1922. Brit. M. J., 1922, ii, 155.
34. Idem. The physics of the lungs and pleuræ. (Austral. Med. Cong., 1923.) Brit. M. J., 1924, i, 71.
35. Macewen and Others. Osteotomy for genu valgum. Discussion at Copenhagen, 1884. Tr. Cong. Internat. d. Sci. Méd., Copenhagen, 1886, ii, 72.
36. McGregor-Robertson. Obituary tribute to Macewen. Lancet, 1924, March 29.
37. Moynihan, Sir Berkeley. John B. Murphy, Surgeon. Surg., Gynec. & Obst., 1920, 31, 549.
38. Ogston. Operative treatment of genu valgum. Edinburgh M. J., 1877, 782, March.
39. Osler. The Principles and Practice of Medicine. 6th ed., 1905, p. 996.
40. Patrick. Obituary tribute to Macewen. Glasgow M. J., 1924, April.
41. Pringle. Obituary tribute to Macewen. Brit. M. J., 1924, March 29.
42. Ruskin. War. Crown of Wild Olive. Lecture III. (Delivered at the Royal Military Academy, Woolwich, 1865.)
43. Idem. Athena in the Heart. The Queen of the Air. Lecture III, 1869.
44. Sargent. Obituary tribute to Macewen. Brit. M. J., 1924, March 29.
45. Thomson, Sir St. Clair. A house-surgeon's memories of Joseph Lister. Ann. Med. Hist., 1919, ii, No. 2.
46. Von Graefe. Ueber Complikation von Sehnerventzuendung mit Gehirnkrankheiten. Arch. f. Ophthal., 1860, vii, 58.
47. Young. Obituary tribute to von Mikulicz. Glasgow M. J., 1905. August.
48. Idem. Traditions of the Regius Chair of Surgery in the University of Glasgow. Inaugural Address, 1924, October 15.
49. Idem. The limitations of surgery. Presidential address, Roy. Med-Chir. Soc., Glasgow, 1924, October. Glasgow M. J., 1924, November.
50. Idem. Sir William Macewen. An Oration delivered in the University of Glasgow at the commemoration of benefactors, June 23, 1926. Glasgow University Publications, iv.